THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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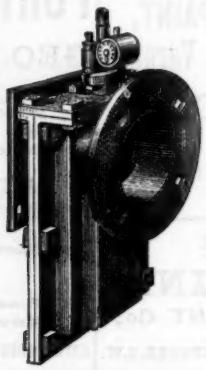

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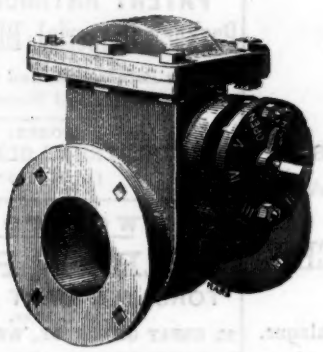

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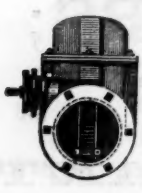

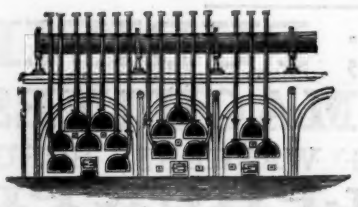

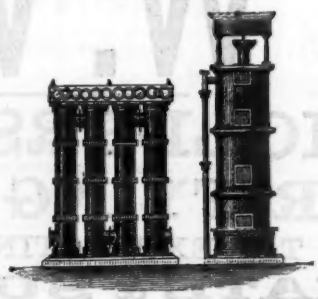

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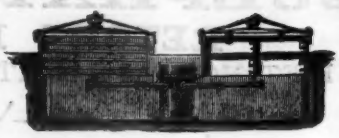

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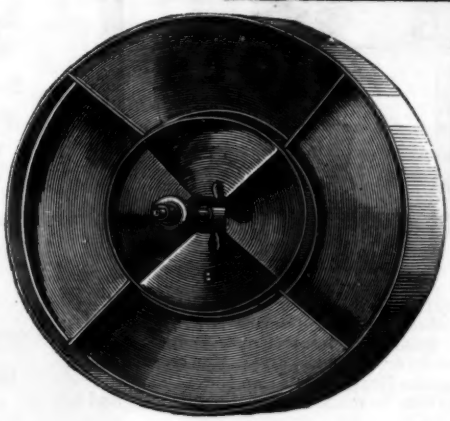

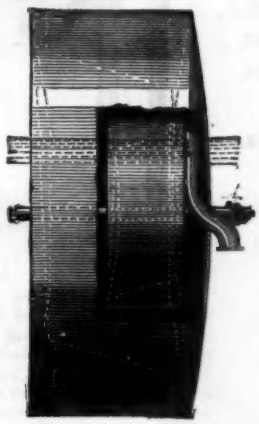

Meters fitted with this Patent Drum discharge the same volume of gas at each revolution, irrespective of the water-line, and are consequently noted for correct registration; they are uniform in appearance externally with our ordinary Meters, and are made in both Tin and Cast-Iron Cases.

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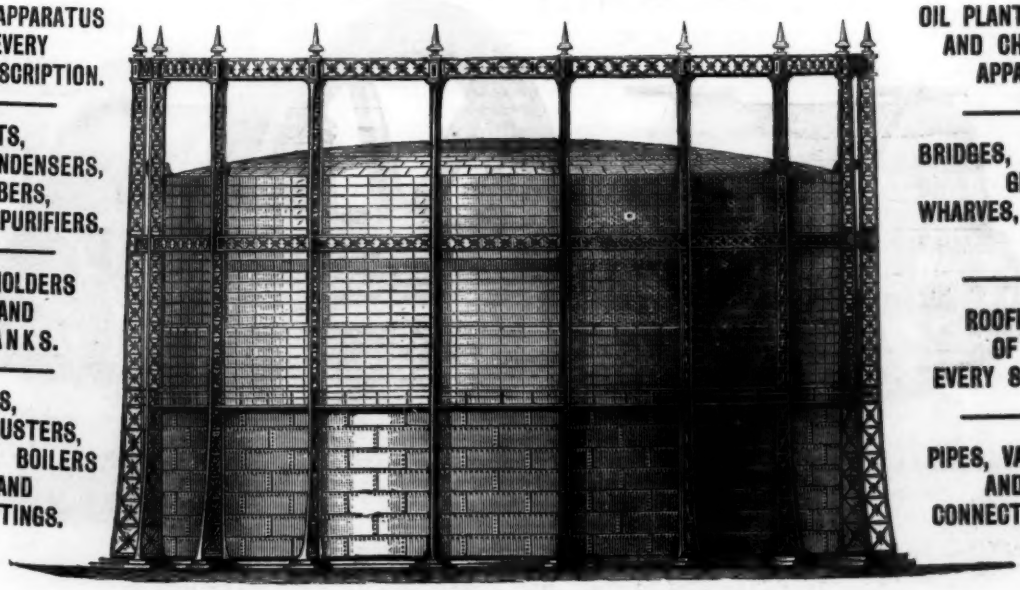

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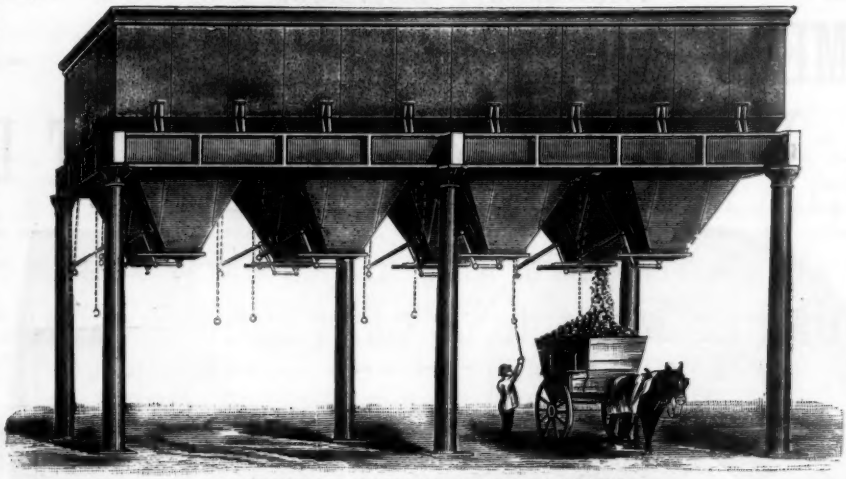

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Columns,
Beams,
Floor Plates,
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Washers,
Scrubbers,
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Valves,
Tanks,
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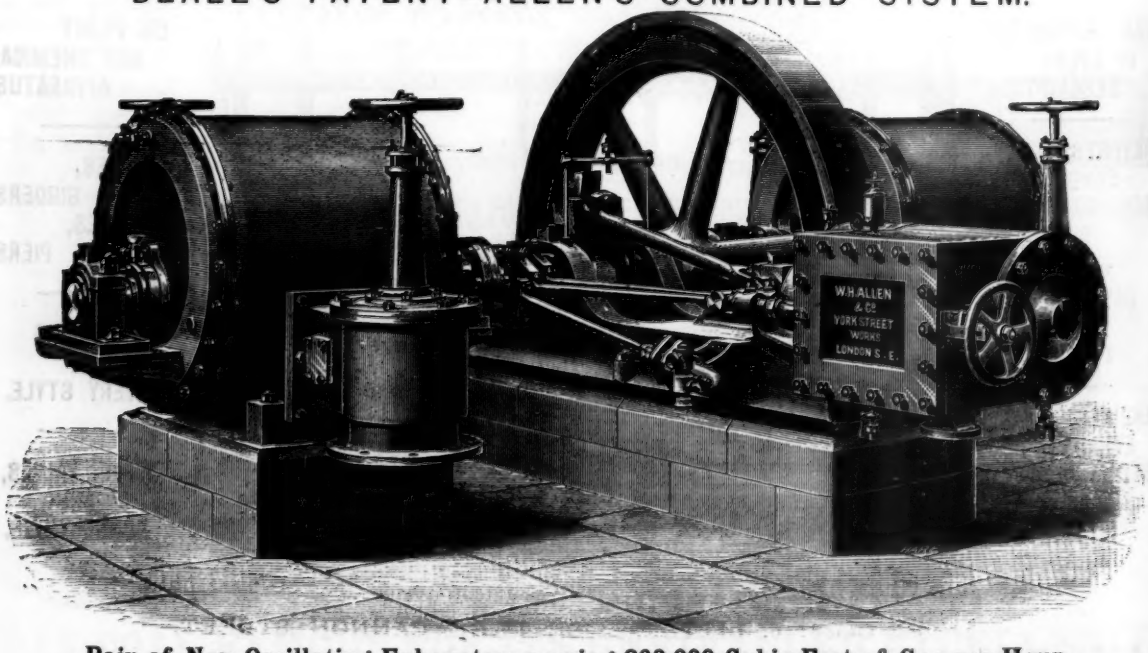

Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

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GAS PRODUCER AND REGENERATIVE SYSTEM OF HEATING RETORTS.

The Patentee's Settings on the Shallow Sunk Chamber Plan,

AND OF FROM

One to Eight Retorts per Oven,

Are at once the most inexpensive and efficacious that can possibly be devised, and are giving absolute satisfaction where in use. By a new and improved means, the Producers of all Settings are now filled directly from the Retorts.

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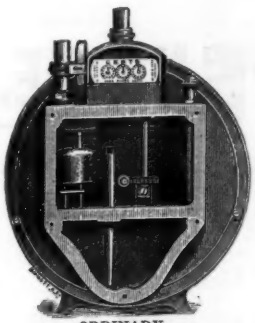

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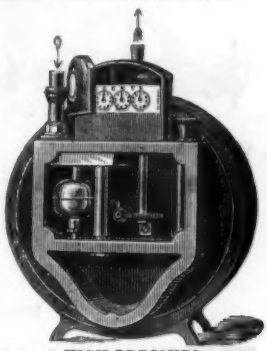

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MORE THAN 150,000 IN USE.

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TO WORK ON THE DOWN PIPE,

For Regenerative and other Lamps.

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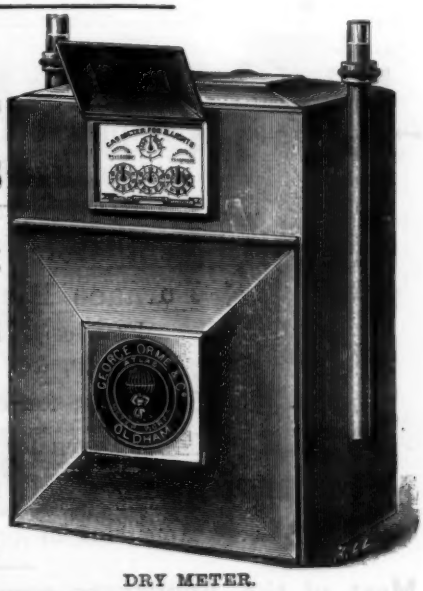

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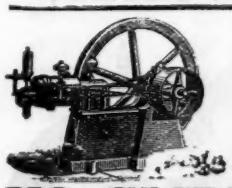

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20 PER CENT. CHEAPER THAN ANY OTHER

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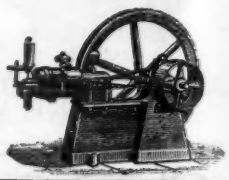

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Gas Exhausters with Automatic Governor working on Steam Spindle; entirely self-acting.

Revivifying Blowers and Exhausters, for continuous or intermittent use.

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Apparatus for Acid and Corrosive Vapours and Liquids.

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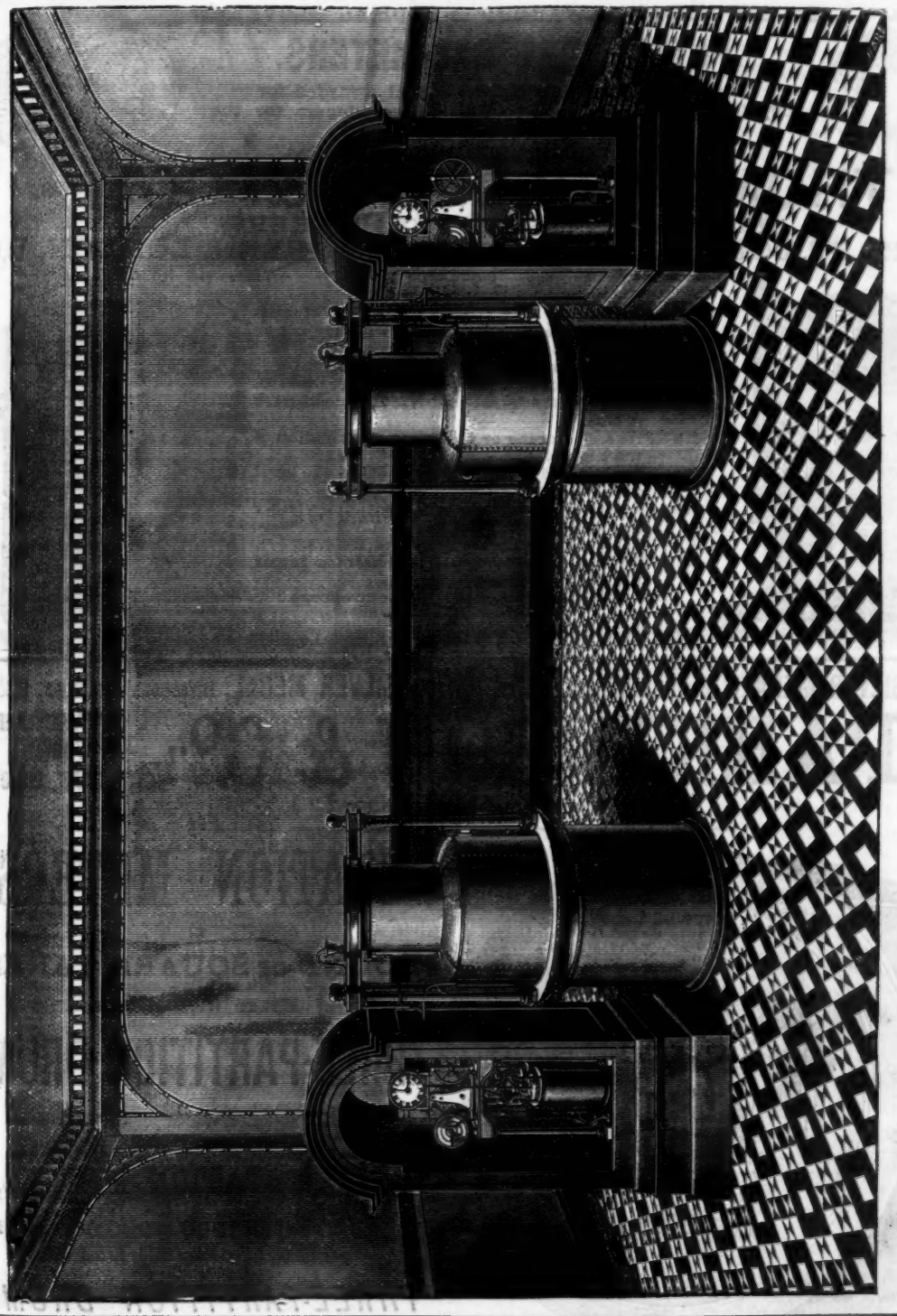

GOVERNORS AND PRESSURE CHANGERS.

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— ESTABLISHED 1827 —

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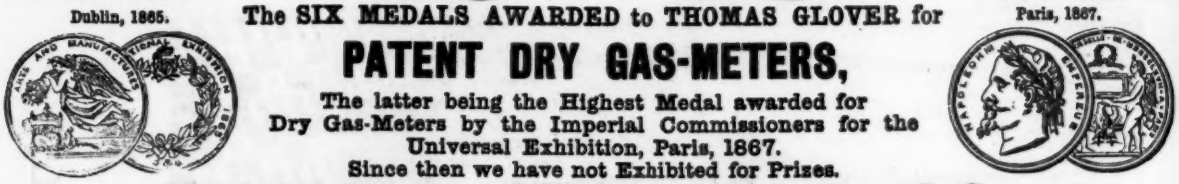
London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.



The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

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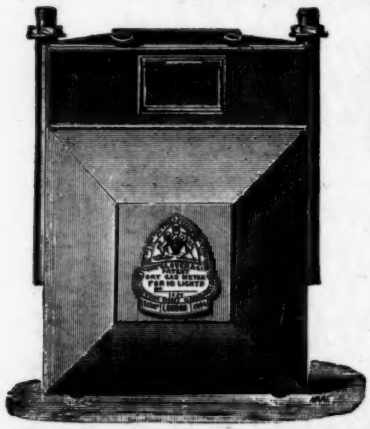

1st—Are a remedy for all the defects of Wet Meters.
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by frost, however severe.
5th—Are the most accurate & unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Meters fitted with Grey's Index or Harding's Counter.

GOLD & SILVER MEDALS, Health Exhibition, London, 1884. **SILVER MEDAL,** Inventions Exhibition, 1885.

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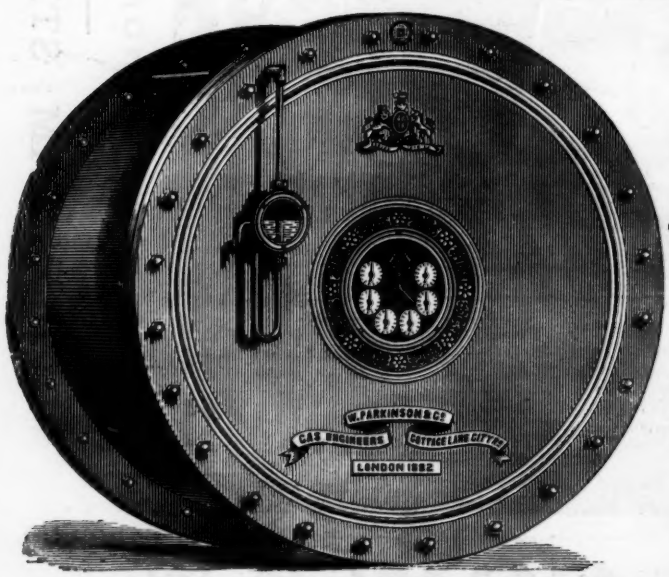

STATION METERS

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ROUND or SQUARE TANKS,

FITTED WITH PATENT

THREE-PARTITION DRUMS

MORE THAN

250 STATION METERS,

Varying in size from 1200 to 200,000 cubic feet per hour, have been sold, fitted with

THREE-PARTITION DRUMS,

Since their introduction three years since.

ROUND METERS as above are kept in Stock in all Sizes, ready to send away at the shortest notice. Compact, portable, and very easily fixed. An Improved Overflow Water-line Regulator fitted to every Meter.

PRICES VERY MODERATE.

DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.

(See also Advt., p. 508.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 12, 1889.

THE BOARD OF TRADE AND THE LONDON COUNTY COUNCIL UPON THE METROPOLITAN GAS SUPPLY.

THE report that has been circulated respecting the intention of the Board of Trade to introduce a Bill in Parliament for amending the law relating to the testing of gas sold in London, has naturally attracted attention to this subject. The first announcement of this intelligence was made by Mr. George Livesey in the course of his speech to the shareholders at the recent South Metropolitan meeting, which happened to be a day or two after Mr. Calcraft, of the Board of Trade, had broached the subject to him. We understand that about the same time Mr. Calcraft saw Mr. J. Orwell Phillips and Mr. Trewby, for The Gaslight and Coke Company, and talked the matter over with them. Knowing that these consultations had been occurring, we took occasion to procure and publish last week all available information regarding the various standards of light and other points of photometry that might be supposed to be in the minds of those who were engaged in discussing the possibilities of reform. As Mr. Calcraft took steps to learn the views of the Gas Companies, it is to be supposed that he acted similarly with regard to the other parties interested in the question. It may therefore be regarded as certain that the matter has within the past week or two received the serious attention of the Department, with the object of ascertaining whether all the inquiry and research that have been directed to the subject of the parliamentary standard candle and its substitutes during the past decade, provide sufficient ground for an alteration of the law. We are in a position to state positively on this head that the result has been negative. The Board of Trade have watched the increasing tension between the Metropolitan Gas Referees, the Chief Gas Examiner, and the Gas Companies, with respect to gas testing; and, having regard to all that has been said about the standard of light, the construction of photometers, &c., it was thought, very reasonably, that the time was ripe for an attempt to unite the contending parties in support of an amendment of the law. The attempt has been made, and has failed; and the much-abused candle is now as little likely as at any time during the past to be deposed in favour of any other standard. It seems that all agree as to the unsatisfactoriness of the actual practice; but there is no agreement as to what should be substituted for it. The Board of Trade had no desire to force the matter, but only offered good offices if there could be said to be any generally acceptable way out of the present troubles. The greatest length that the Department was disposed to go was the promotion of an enabling Act, under which a Commission might be issued, upon whose recommendation the Department might, by an Order in Council, authorize any desirable change in photometrical procedure. All idea of taking such a step has been abandoned, however, in view of the irreconcilable attitudes of the parties most interested.

The fact of the matter appears to be that the universally accepted standard of light or method of determining the illuminating power of gas for statutory purposes, has yet to be discovered. The candle is bad, and the construction of photometers is unsettled; but gas-makers in general have not sufficient confidence in any of the proposed substitutes to induce them to support a change of the law. Some may think the existing chaos so bad and worrying that almost any alteration that can be respectably recommended must be preferable; but the majority in all probability hold that it is better to endure the ills they have than fly to others that they know nothing about. The candle may be a rough-and-ready standard; but when to abandon it for any of the proposed substitutes is only to drop one makeshift and take up with another, the argument for letting matters alone becomes very weighty. We stated the case of the standards fairly last week, and desire to give all due credit to the ingenuity that has gone to the production of the different standards then enumerated, and also to the patience that has tested them and established their laboratory reputations. If asked, however, whether in our judgment any of them satisfies the requirements of a perfect legal standard, we could not give an affirmative response. They do not inspire that feeling of confidence which should be the necessary concomitant of an appeal for legislative sanction and enforcement. It may be hopeless to expect the precision of the two-foot rule in such a matter as the measurement of the comparative brilliancy of two lights; but we do not despair of discovering some system of determining the luminous value of coal gas which shall commend itself to all concerned in such measurements.

The Board of Trade are less disposed to force on any gas legislation just now, as the London County Council have not yet settled into work. This body will have a good deal to say upon gas questions when they are ready for them; and even now, as will be seen from the report of their last meeting in another column, they are preparing for the work before them. The policy of the Gas Companies came up for notice in connection with the proposition that the Council should abandon the coal dues, when the difference between knowledge and prejudice was made clearly perceptible in the speeches of Sir T. Farrer and Mr. A. Hoare respectively. In the end it was decided to oppose the attempt of the City

Corporation and the moribund Metropolitan Board of Works to obtain a renewal of the dues; which is so far satisfactory. The *agenda* for the same meeting also contained a notice of motion in the name of Mr. James Beal, for procuring a declaration of policy on the part of the Council with reference to the acquisition of the Water and Gas Companies; but this business was not reached. We have entertained the opinion that whatever the County Council might be disposed to do respecting the Water Companies, it would be long before they could feel strong enough to tackle the question of gas transfer. It seems that we have been mistaken, if last Tuesday's *agenda* is to be taken as an indication of the speed with which the Council mean to place themselves in front of their chief difficulties. As to this, however, we are by no means assured. It is more likely that Mr. Beal, who is an aged man, and has been a gas agitator since a period anterior to the lifetime of the present generation, is in a hurry for a solution which he may regard as the crown of his life-work. It remains to be seen whether he is in touch with any considerable party of the Council in regard to this matter. On the face of it, there is a look of temerity about the proposal to broach such a project before a public body not yet fully established for the transaction of routine business. There is, however, a not very satisfactory display of ardour, on the part of many members of the Council, with regard to enterprises more or less removed from the immediate necessities of the hour. They appear too anxious for fuller parliamentary powers for attaining a variety of objects at present removed from practical politics. Unless this telescopic vision is barred for awhile, the Council will possibly make a more deplorable mess of their work than did the Board which they are superseding. It should be borne in mind that what brought the Metropolitan Board of Works into disgrace was not their larger enterprises, but the petty blunders, oversights, and fatuities of their dealings with theatres, public-houses, street frontages, and similar comparatively small matters. So likewise if the County Council open their mouths too wide at first, and fix their care too exclusively upon the acquisition of the gas supply, the taxation of ground rents, and similar large questions which yet rest within the discretion of Parliament to leave with or withhold from them, they will run great risks of tripping over the multiplicity of ordinary matters of administration for the conduct of which they are primarily responsible. With regard to the gas supply, for example, it may be reasonably suggested that the Council had better address themselves to the immediate duty of dealing with the question of gas testing, which is a legacy from the expiring Board of Works, before approaching a problem which will tax the statesmanship of their best men to comprehend, to say nothing about a settlement.

NEW RAILWAY RATES FOR COAL.

In the article which appears in another part of the Journal to-day, Mr. J. Ferguson Bell, of Stafford, has done good service in calling attention to the new classification of coal under the Railway and Canal Traffic Act, 1888, which is a matter of the gravest importance for all gas manufacturers dependent wholly or in part upon railways for the conveyance of their coal supplies. Mr. Bell makes out that the effect of recent legislation will be to considerably increase the rates leviable by the Railway Companies for the carriage of coal, not only in respect of mileage, but also for terminal charges. His table certainly shows that if the new powers are utilized, Gas Companies are likely to be in a bad case, with an addition of 60 per cent. to their carriage expenses for coal. The only saving consideration in the matter is that the rates are admittedly maximum, and as such are likely, in the majority of instances, to be treated like maximum prices for gas. It would be awkward if Gas Companies were to agitate against the new rates without making allowance for this consideration, and so lay themselves open to a damaging retort of the *tu quoque* order. Looking at the subject in this light, it certainly appears as though Mr. Bell ought to have added another column to his table. He has compared the present and proposed rates, with startling results; but the former are the rates actually charged, and the latter merely the rates that may possibly be enforced in the future. The question that naturally occurs to a reader of Mr. Bell's figures is, What is the difference between the actual and the maximum rates now? If the Railway Companies always demanded their maximum dues, there would be more cause for alarm than really exists. If, on the other hand, competition or something else operates at present to make the Railway Companies charge, not so much as they might demand, but as little as they can carry the coal for, there is no ground for alarm while the same considerations obtain. At the same time, of course, nobody likes to see even an unapproached maximum impost raised needlessly, without knowing the reason why. After all, the great safeguard of users of railways is competition. It is with much reluctance that one is driven to admit, with regard to British railway management, that the eagerness with which the companies pursue, and the liberality with which they treat competitive business, present a very great contrast to their behaviour in those instances where they have all their own way. It is a pity that the companies should be open to this reproach; but it is impossible to deny the fact that railway traffic managers in general think it the height of business shrewdness to be grasping where they can, in order that they may be able to cut rates and starve a rival at a competing point. If, therefore, the new order of things in regard to coal carriage rates affects anybody, the sufferers will be the Gas Companies and Corporations situated where there is no railway competition. If these are not already alive to their danger, they have much reason to be grateful to Mr. Bell for arousing them to the realities of their position.

MR. ELLIS LEVER AND GAS AFFAIRS IN LEEDS AND ELSEWHERE.

What has become of the redoubtable Mr. Ellis Lever, that champion of the cause of commercial purity, and disinterested friend of the ratepayers of Leeds, Salford, Halifax, and elsewhere? We ask the question because there is such a thing as getting tired of waiting, which is precisely our position with regard to the threatened "exposures" in connection with the gas supply of the towns named. Halifax one is weary of mentioning. Nothing is done week after week to justify the vaunts of the Mayor, who stands convicted, through his own default to make good his words, of what the late Thomas Carlyle would have called "windbaggery." Mr. Lever has backed out of his Salford engagements; and now it is reported from Leeds that contumely has been heaped upon his name by the Chairman of the Gas Committee, as a sort of supplement to the strong course, already announced, of instructing the Town Clerk not to answer any further letters from him. Anything more futile than these agitations respecting gas coal contracts, started by Mr. Lever for some inscrutable reason, and dropped as irrationally, has never occupied the public mind. He has acted like the boy in *Punch's* celebrated caricature, who chalked up "No "Popery" on a wall, and then ran away. So Mr. Lever, after disturbing the public authorities of several towns with wholesale allegations of fraud and corruption, which threw the ever-suspicious populace into great turmoil, has worn out everybody's patience, and has after all been denounced in public as an unreliable meddler. Nothing could be more unsatisfactory than this result, for all parties concerned. Some people are so censorious that they treat all accusations as proved crimes; and nothing will convince this section of the community that Mr. Lever had no justification for singling out Leeds and Salford as objects of his attacks on the probity of public officers. The natural comment that will be made upon this peculiar conduct of Mr. Lever is: "If there was "no ground to go upon, he ought never to have opened his "mouth. Having done this, he should not have desisted until "the matter was cleared up." Either in omission or commission, Mr. Lever has done very wrong—more, he has gone out of his way to put himself in the wrong before the Leeds Corporation. Meanwhile, the Leeds Gas Committee and the Town Council are all at sixes and sevens. Certain aldermen and councillors accuse the Committee of malpractices such as those of which rabid Local Boards are sometimes given to accusing Gas Companies withal. One man quotes statistics against another in the course of debate, and nobody knows which to believe, for neither is a recognized expert. A town councillor declared in a recent meeting that they ought to have a Gas Engineer, which was the most sensible thing that has been said in Leeds for a long time; but the remark passed unnoticed.

DISAFFECTION AT THE HALIFAX GAS-WORKS.

More trouble is in store for the Halifax Gas Committee. As was the case at Salford some months ago, the advent of a new Manager has led to differences with the workmen. It is only a new version of the old story. Other men, other manners. No two Gas Managers have exactly the same ideas respecting the thousand-and-one things which come within range of their multifarious duties. In entering on a new post, every man worth his salt sees a wide field of

usefulness before him—if it is only in correcting what he cannot but regard as the mistakes of his predecessor. A large and complicated undertaking like a modern gas-works is sure to present some features which do not accord with his notion of the fitness of things; and it will be well for him if his reforming zeal does not raise a storm about his ears. The inhabitants of different towns often have little local jealousies and quarrels, which keep them in a state of perpetual warfare. It is likely, therefore, to go hard with the new Manager if he shows a fondness for the things he has left behind him, or allows Little Pedlington to imagine he thinks matters are better managed in Dullborough whence he came. Both Mr. Shoubridge, at Salford, and Mr. Holgate, at Halifax, are experiencing the truth of this. Half the difficulty at the Halifax works just now seems due to the fact that the man selected to fill the office of Superintendent hails from Batley, where Mr. Holgate was himself for a short time Manager. The foremen who are leading the revolt seem to object to the new official as an individual at least as much as to the fact that anyone is appointed over them. Had an advertisement been published, and someone been selected from a host of candidates, all would apparently have been well. But the Halifax foremen and stokers and other workmen do not like the prospect of being "bossed" by a man from Batley. Hence the trouble. It is nearly the same at Salford. Mr. Shoubridge is being continually taken to task by those irresponsible scribes, the "Constant Readers" of the local press, as well as by the "Comrades" of the Socialist organization, for his supposed preference for Birmingham men and Birmingham ways. Most ridiculous allegations are made by these disinterested individuals; the obvious intention being to arouse local jealousy and make things unpleasant for the new Manager, who is not forgiven for the changes he made in the retort-house some months ago. Both instances go to prove the old truth that the path of the reformer is not strewn with roses. A new Manager who sets himself the task of bringing an old-established undertaking into harmony with any preconceived set of ideas which he may entertain, or who attempts to rectify the abuses, great or small, which he sees around him, will find that he has a rugged road to travel. The probability is that at the outset he will "bark his shins" against a heap of local prejudices; and he will be fortunate indeed if he reaches his goal without a tumble. We, however, wish both Mr. Shoubridge and Mr. Holgate a better fate than often befalls men who are handicapped by such difficulties as they have to surmount. Since the foregoing was in type, we learn by the telegram from our Halifax Correspondent which appears elsewhere, that the Mayor and the Gas Committee had a conference with the men yesterday afternoon, but could not yield to their demands. The result was that the men left work in a body.

PETROLEUM PROSPECTS.

Another of those petroleum pamphlets has been published by Mr. Charles Marvin, in which he appears to alternately worship and condemn mineral oil. This time the theme of his somewhat sensational pages is "The Coming Oil Age;" and his main object is apparently to draw attention to the existence of vast reserves of petroleum in Burma and the North-West Provinces of the Dominion of Canada. He declares oracularly that there is enough oil in Burma to light all Asia, and more than enough in Canada to serve America when the Pennsylvanian fields give out. The trifling drawback of these being heavy oils, requiring a new pattern of lamp, does not oppress Mr. Marvin, who seems to think that Messrs. Defries and one or two Russian firms can turn out as many lamps to burn heavy oil as the world will require. Mr. Marvin is a striking, and to a certain extent an amusing and picturesque writer. He succeeds in dressing up repulsive statistics of petroleum production and consumption in a readable form, and gets abundantly quoted in the newspapers. He is too effusive and given to sweeping generalities, however, to be taken seriously at all times. Sober sense revolts against many of his wild prophecies on the subject of oil; and experience refuses to accept his summary explanations of complex historical facts. It is necessary to notice Mr. Marvin occasionally, because he has undoubtedly made a very deep impression upon some people, and has been enlisted to advance the cause of petroleum against gas by delivering addresses in places where Messrs. Defries attempt organized invasion of the Gas Company's domain. We have no desire to be hard upon Mr. Marvin, and have certainly no wish to disparage the heavy-oil Defries lamps, which are admirable things in their way. At the same time, when the former, resting upon the latter, makes the statement that, "as a matter of fact, even in the very heart of London, and "with oil at 8d. per gallon, petroleum light is less than one-"third the price of gas," we think it high time to protest. Mr. Marvin carefully omits to disclose the grounds on which he makes this daring assertion; but we may find in an evidently inspired paragraph in *Engineering* an example of the way in which comparisons of the kind can be made. An oil-lamp of nominally 43-candle power is said to burn a pennyworth of oil in five hours; "while a three-jet gaselier, "giving the same light, consumes gas to the value of 5d. in "five hours, calculating the gas at 4s. 6d. per 1000 cubic "feet." To take one oil-lamp as equivalent to three gas-burners is almost as good as the Brush contention in regard to "French measurement" of electric lamps. It is a little too impudent, however, to carry very far. Mr. Marvin predicts that, in comparison with oil-lamps, "gas will have a "very bad time of it." Another light of the future! We may nevertheless make shift to rest in peace with the business of the present, and let Mr. Marvin and the electricians squabble over their shadowy inheritance of the time to come.

Mr. E. Chadwick has been promoted to the degree of K.C.B. from the Civil Division of the Order of the Bath.

The will of the late Mr. David Hulett, of High Holborn and Belvedere, has been proved; the personalty amounting to upwards of £243,000.

The Directors of the East London Water Company have decided to recommend a dividend at the rate of 7½ per cent. per annum for the past half year.

Messrs. Duncan Bros. have transferred the department of their business which specially relates to the design, construction, and equipment of pipe-lines, to the Steel Pipe Company, Limited, of Victoria Mansions, Westminster, and Glasgow.

At the monthly ballot for members at last Tuesday's meeting of the Institution of Civil Engineers, Mr. H. J. Gooch, of the Chelsea Water-Works Company, and Mr. F. W. M'Cullough, of the Belfast Corporation Water-Works were elected associate members.

The will of the late Mr. Richard Bradshaw, for many years Chairman of the Commercial Gas Company, whose death on the 22nd of January last was announced in our columns at the time, has been proved; the personalty being declared at £156,747.

At the meeting of the London County Council to-morrow, Mr. Benn intends to move to refer to the Special Purposes Committee the question of the desirability of the Council applying to the Board of Trade to introduce a Bill in the present session to legalize the use of the portable photometer.

Mr. W. Hammond, who for 27 years held the appointment of Secretary of the Hampton Court Gas Company, has been compelled to resign on account of ill-health; and in consideration of his long and efficient service, the shareholders have granted him a retiring allowance of £150 per annum.

In reference to the recent trials, under the auspices of the Society of Arts, of motors suitable for electric lighting purposes, of which an account is given in another part of the Journal, Professor Kennedy (one of the Judges) will read a paper on the subject at the Society's rooms on the 20th inst.

The motion of which notice has been given by Mr. James Beal, in regard to the acquisition of the undertakings of the London Gas and Water Companies by the County Council, to which reference was made in the Journal last Tuesday, was not reached at the meeting of the Council on that day, and therefore it still stands on the *agenda*.

In Dr. Pole's interesting biography of Sir W. Siemens, which was reviewed in the Journal for Nov. 6 last year, it was intimated that his complete scientific works were being prepared for publication. They have now been issued under the editorship of Mr. E. F. Bamber, C.E. (who was Sir William's private secretary for the last ten years of his life), in three volumes, copies of which have been forwarded to us by the publisher, Mr. John Murray. In the first volume, the papers dealing with the subject of heat and metallurgy are collected; the second is devoted to those on electricity and miscellaneous questions; and the third consists of addresses, lectures, letters to the press, &c. The contents of the volumes range over a period extending from 1850 to 1883; and the entire work may be taken as complementary to that of Dr. Pole. As in the case of the biography, the present volumes have been issued under the authority of Sir William's executors; and they have been produced with all the care in preparation which characterized that book; the text being illustrated with a large number of plates. The Editor was not only specially qualified for his work, but had the valuable assistance of Mr. John Head, who has been for many years connected with the firm of which Sir William was the principal member. The contents of the volumes before us do not call for detailed notice now; but it should be mentioned that many of the subjects dealt with necessarily refer to matters in which our readers are specially interested.

Water and Sanitary Affairs.

The article by Dr. Robson Roose on the "London Water "Supply" has been more widely noticed than any other contribution to the current number of the *Fortnightly Review*. Some of our contemporaries have seized upon it as affording cogent proof of the satisfactory character of the Metropolitan Water Supply, and one or two of them have welcomed it as the stepping-stone for further agitation against the Water Companies. To those, however, who carefully consider what the writer has to say, it will appear that some of his contentions are based upon very slender evidence, and that at least one of his arguments is deficient in sound logic. The question of the pollution of the Thames, to which Dr. Robson Roose somewhat superficially refers, is being dealt with in our series of articles on the "Relation of Water "Supply and Disease;" but there remain one or two points in the article which it is convenient and desirable to notice independently. For, it is to be observed that after a tolerably painstaking inquiry as to the sources and methods of supply, Dr. Robson Roose declares that the precautions taken to ensure that the water, when delivered to the consumer, shall be "as pure as circumstances permit," are such that no charge of neglect can be sustained against the Companies. To admit this is only to give the Water Companies their undoubted due; but, at the same time, the admission is an important one, and may hereafter be useful for the purpose of reference. But Dr. Roose goes further, and says in plain terms that the Companies have always been in advance of public opinion on improvements in water supply. "Not only do they fulfil their con-"tracts, but they do not limit themselves to a bare com-"pliance with the provisions of Acts of Parliament; they "frequently adopt measures for the general improvement of "the supplies, and exhibit proofs of their anxiety to dis-"charge the duties of their position towards the public." This, be it remembered, is testimony from a critic who is by no means predisposed to favour the Companies, and testimony, too, which no impartial inquirer will find himself able to impugn. So far, then, the Metropolitan Water Companies have to thank Dr. Robson Roose—not, indeed, for a generous, but for a just and candid verdict. But when the writer gets towards the end of the article, it will be seen, as we have intimated, that he has left his logic behind. It is not suggested by him that a public body could have done more than the Companies have done—the probability is they would have accomplished considerably less; and yet we find Dr. Roose asserting in general terms that great improvements could be effected by the transference of the Metropolitan Water-Works to a public authority! The writer seems to think that these great improvements would arise from the consolidation of establishments, increased vigilance in collecting rates, "with the consequent cheapness of the water," and unity of action. Anything more vague and shadowy than this outline of probable benefits it would be difficult to imagine. It has yet to be shown that consolidation, which practically means centralization, would be beneficial to the millions of water consumers to whose necessities the various Companies now so efficiently minister. The "increased vigilance" certainly has not been conspicuous in those instances in which provincial authorities have acquired local water undertakings; and, assuredly, the cheapness of water is not a consequence which would necessarily follow the other "improvements" if and when they shall be brought about. If the system of payment by rates should still be retained—as, indeed, there is no reason to doubt—is it at all likely that those rates would be lower than they are at the present moment? It comes to this: The Water Companies have done their duty, and something more. The public are content; and yet Dr. Roose, though admitting what we have stated, advocates a change. He does so on grounds which "melt into thin air" when examined by the light of reasonable probability, or when tested by the result of those experiments which have already been made and regretted in not a few provincial districts.

The Dinsmore Gas Process.—We have received from Mr. Isaac Carr the following particulars of the working of this process at Widnes from Nov. 29th, 1888, to the 4th inst.—Coal carbonized, 267 tons 0 cwt. 2 qrs.; gas made 3,262,000 cubic feet, or at the rate of 12,216 cubic feet per ton, of an average illuminating power of 22·17 candles. Mr Carr adds that the process continues to work satisfactorily.

Essays, Commentaries, and Reviews.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 502.)

A week of excitement in all the Stock Exchanges of Europe. The resignation of King Milan was a sufficient item to produce no slight uneasiness; but the "Copper Crash" in Paris has thrown all else into the shade. It is not within our special lines to say much about this incident, which has been fully told in other journals; but we cannot help noting how aptly it comes as a commentary upon what we said last week as to a financial catastrophe being imminent. It may be this country's turn next. The hunger to gain wealth without producing it—to become rich at one stroke, and at somebody's else's expense, pervades all classes. Founded on rottenness, its inevitable end is disaster. However, we only refer to the subject in order to note that the markets in general were very much depressed last week, and closed at about their flattest. The Money Market shows no noteworthy change, and may be quoted steady. The Gas Market has been much more active than it was the week before. It has also been extremely steady; and the changes of quotation are both rare and slight. An increase of business was apparent in Gaslight "A," coupled with a slight tendency to higher figures. The best mark was on Friday, at 258½; but the single transaction recorded on Saturday was at 256. There was a fair demand, too, for debenture and preference issues. Business in South Metropolitan was confined to the "B," which changed hands at about average figures throughout the week, with one special transaction in the debenture stock. Nothing at all has been marked in Commercials, though we have heard of business being done in them. The old stock is quoted 1 better; but the prices do not seem to be high enough yet to bring stock into the market. Business in Suburban and Provincial undertakings has been of the usual small volume; but it includes dealings in the rarely-touched new shares of Crystal Palace and Tottenham. The accounts of the former Company for the December half year are chiefly noticeable for remarkably good coke sales. Among the Foreign division, Imperial Continental has been fairly active at steady figures; but nothing has moved except San Paulo, which is ½ better. The Metropolitan Company of Melbourne, whose debentures stand so well here, are declaring an 18 per cent. dividend. In Water, there is not much to notice, except the firmness of East London (the approaching 7½ per cent. dividend of which has now been officially announced), together with a slight weakness in West Middlesex, which receded 1.

The daily operations were: Moderate business in Gas on Monday, at good average figures. Commercial old rose 1. Water was quiet, but very firm. On Tuesday, the Gas business was largely in Gaslight "A" at existing prices. Water was busier and generally steady, but for a fall of 1 in West Middlesex. Business in Gas and in Water on Wednesday was moderate, without any special feature. There was a little more activity on Thursday, especially in Gaslight issues; and quotations again closed without change. Business in Water was about the same as the day before. Business in Gas continued to be limited through Friday, without any feature except good average firmness. Water was quiet. Saturday's business was quite up to the usual standard. San Paulo rose ½. Water was brisk; but quotations did not move.

ELECTRIC LIGHTING MEMORANDA.

THE FAILURE OF ELECTRIC LIGHTING FOR STREETS—ELECTRIC LIGHTING BY WATER POWER IN SWITZERLAND—THE PROGRESS OF ELECTRIC LIGHTING IN AMERICA—RESULT OF THE GAULARD AND GIBBS APPEAL—THE BUSINESS OF THE BRUSH COMPANY.

The failure of incandescent lighting for streets and outdoor spaces, as shown once more in the case of Leamington, is a very sore point with electricians. The *Electrical Review* is very outspoken upon the subject, declaring that "as a result of the folly of trying to light streets by means of incandescent lamps, we shall for a long time to come have Leamington pointed out as an instance of the triumph of gas lighting over electric lighting"—to which remark we take the liberty of rejoining the query, Why not? If it was a question of mere crowing, there would be no reason why the partizans of gas should not make the most of their advantage, as their rivals most certainly would do in the circumstances. The peculiarity of electricians' crowing, however, is that it is always done in advance. When they obtain a contract or open an installation, they make loud proclamation of the deeds they are about to do; but when they clear out defeated, their friends considerately ignore the retreat. With regard to Leamington, it will be noticed that our electrical contemporary writes of incandescent lighting as though it were notoriously unfitted for street lamps. In this view we agree; but it must be remembered that the great advocate of electric lighting for towns, Mr. W. H. Preece, maintains the exact contrary. It is true that his ideal of the proper way of lighting streets, by means of lamps hung midway across the thoroughfare, is impracticable. If he is not allowed to interfere with the right of way, however, Mr. Preece still holds that incandescent lamps are best for streets, because they are not so glaring as arcs. Here, again, he is right. No arc lighting that has ever been tried in England for common roads (in connection with which the question of economy is more to be considered than in the few cases where arc lamps have been adopted for esplanades, &c.) has been found really satisfactory. Unless the lamps are placed extravagantly thickly, the effect is

spotty and bewildering—a very caricature of street lighting. The question of street lighting therefore becomes a very serious one for electricians. The net result of such "modern instances" as the failures at Leamington and Barnet, taken in conjunction with the recorded failures of arc lamps to give that equable, diffused light which is of the first importance in road lighting, is to demonstrate that electric lighting of both kinds is inapplicable to such a purpose. It does not necessarily follow that a novelty must be better than the established system it is introduced to supplant. When the Duke of Wellington witnessed some experiments with the then great novelty, gun-cotton, of which wonderful results were expected, among them the supersession of gunpowder, he remarked that if the gun-cotton had been first invented everybody would have said that gunpowder was a great improvement upon it. Gun-cotton has been vastly improved since then; but it has not taken the place of gunpowder. Similarly, if gas were the novelty at Leamington and elsewhere that electricity is, it would be better appreciated. Experience shows, however, that the new may improve alongside of, but not to the extinction or restriction of, the old system. The position in which Leamington leaves the electricians is that they can no longer trade on the novelty of their system; but must justify it on some more reasonable grounds than mere fancy.

If electric lighting is practicable at a reasonable cost in any country of Europe, it should be available for Switzerland, which has no coal for gas making except what is brought a great distance by rail, and on the other hand possesses great water-power facilities not utilized to any considerable extent. Accordingly a number of electric lighting installations employing water power have been started in several Swiss cantons. A great drawback to the commercial success of these establishments, however, is the small size and poverty of the towns. Recently an example of the transformer system of electrical supply devised by Messrs. Zipernowsky, Déri, and Blathy, has been started for the service of the two small towns of Dieulefit and Valréas, neither of which is large enough to support a separate undertaking. Two turbines of 50-horse power are employed to begin with, and the current is transmitted to the points of consumption through overhead wires, the trunk mains being 5 kilometres long in one instance and 14 kilometres long in the other. The undertaking was started just before Christmas; and although it is too soon to say how it works, the experiment is undoubtedly interesting and deserving of notice, especially as the locality is too remote to allow of any other kind of lighting.

The convention of the National Electric Light Association was held last month in Chicago, under the presidency of Mr. S. A. Duncan, whose inaugural address may probably be regarded as indicating the high water-mark of electric lighting in the United States, and is consequently interesting to British students of the industry. The Association practically dates from five years ago, when electric lighting in America was settling down into a regular business. At that time, according to the President, arc lighting was the only commercial system, incandescent lighting having scarcely come into use. Now, after the same authority, this system has been established upon its true bases, and the most pressing questions awaiting solution by electricians are those connected with the distribution of power by electricity for locomotion and stationary machinery. The number of central stations and isolated electric lighting installations, of which statistics have been collected by the Association is now 5747, showing an increase of 2067 since the previous year. The number of arc lamps in nightly use in the United States is given as 219,924, and of incandescent lamps 2,504,490. In the same country there are stated to be 53 electric railways in operation, and 44 in construction. The Association has for a year had permanent headquarters in New York, where an energetic propaganda has been carried on. The important subjects of the fire risks of electric lighting and the placing of electrical conduits underground, have been extensively investigated by Special Committees of the Association, and reports thereon were read at the meeting.

The revocation by Mr. Justice Kekewich of the Gaulard and Gibbs patent for distributing electricity by secondary generators has formed the subject of an appeal by the owners of the patent, the National Company for the Distribution of Electricity by Secondary Generators. Judgment has just been pronounced by the Court, to the effect that Justice Kekewich's decision must be upheld; and the consequence of this is that Ferranti's improved system, which is the plan adopted by the Grosvenor Gallery Company, takes the place of the Gaulard and Gibbs device. The latter made an irreparable mistake in depending upon their special form of apparatus, which they believed at first to be superior to all others, and in fact, as the Court remarked, to possess "magical powers." Enlightened by experience, however, the patentees tried in an amended specification to throw over the pattern of their instruments, and by so doing destroyed the legality of their patent. The Court sympathized with them, but the law on the point is perfectly well settled; and so there was nothing for it but to declare the patent hopelessly bad, and dismiss the appeal. This is unfortunate for the National Company; but good for Mr. Ferranti and his backers. Such are the fortunes of patentees of original discoveries and those who improve upon first crude ideas.

The Anglo-American Brush Electric Light Corporation appear to have done very well last year, according to the Directors' report just issued. They show a profit on the year's working of £12,885 after providing for depreciation and bad debts, which is equal to more than 5 per cent. upon the entire capital of the Corporation. Business is also reported to be increasing in consequence of the impetus given to central station work by the amendment of the Electric Lighting Act last year.

THE GAS PAVILION AT THE PARIS EXHIBITION.

We are able to-day, through the courtesy of the Editor of the *Journal des Usines à Gaz* (M. Ph. Delahaye), to give, in the supplement issued with the Journal, drawings and a description of the Gas Pavilion at the Paris Exhibition, which is now rapidly approaching completion. The plans, being exact reproductions of those which appeared in the pages of our French contemporary, necessarily have all the measurements in the metrical system; but this will not militate against their utility to our readers, who will be interested rather in the general arrangements of the interior of the building than in the exact superficial area occupied by each of its constituent parts. The various rooms will be elegantly furnished; and gas will be the only medium employed for lighting, warming, and ventilating them. The fitting up of the interior of the building has engaged the attention of several Sub-Committees of the General Committee, whose labours there is every reason for supposing will result in a display that will be marked by the excellent taste for which our neighbours on the other side of the Channel are renowned. The General Committee invite the co-operation of manufacturers of gas appliances, of whatever kind, in making the exhibition thoroughly representative; and the President (M. Ellissen, of No. 65, Rue de Provence, Paris) will furnish any information that may be required. In the short description accompanying the illustrations, reference is made to the historical collection which is to form part of the display. The Committee are desirous that this should be as complete as possible, so that the improvements effected may be more striking; and any assistance that can be afforded them in this matter will be much appreciated. The Committee are working steadily; and there is good reason for supposing that the Gas Pavilion will be a highly attractive feature of the forthcoming Universal Exhibition.

THE USE OF COMPRESSED AIR FOR VENTILATION.

A good deal of interest has been taken in the recent experimental observations respecting the composition of the atmosphere of public buildings, for which sanitary science is indebted to Dr. Bedson and his colleagues of Newcastle-upon-Tyne, and Professor Carnelley and his fellow-workers at Dundee. Researches of this kind are very useful in many ways. They not only extend our knowledge of the conditions under which people in towns are accustomed to live, but they also by the peculiar character of their revelations give a strong impetus to sanitary movements the necessity of which was previously but imperfectly recognized. It is one thing for an ordinary citizen to feel that the church, or lecture hall, or theatre which he and his family habitually frequent is not so well ventilated as it might be; but the same person's views on the subject are likely to be vividly enlightened after Dr. Bedson or somebody else has told him what this well-known "stuffiness" of the air of a place of public resort really signifies. The ordinary individual who has sat calmly in his pew at church while the common incident has been enacted of two or three ladies fainting during the service, or being supported to the door; the occasional playgoer, who endures the "theatre headache" as an inevitable penalty for his entertainment; the father who hears, scarcely moved, the frequent allusions of his children to the closeness and heat of their schoolrooms—are all likely to take a fresh interest in these evidences of something being wrong with the ventilation if they are told what want of proper aërial sanitation means.

It is probably true, as repeatedly stated, that there is no reliable evidence at present of the propagation of specific diseases through the breathing of poisoned air in public rooms; but such evidence may be supplied at any moment by observations more accurate than have yet been possible. It must not be overlooked that, although the chemical examination of air for carbonic acid is now conducted according to a reliable method, investigations having for their object the qualitative and quantitative determination of dust and living organisms in air are quite tentative at present. Mr. Aitkin has hit upon a method of counting the dust particles in air; and the experiments at Newcastle and Dundee, already alluded to, show that there are known methods of obtaining comparative data regarding the presence in air of bacteria and moulds. It cannot, however, be held that the results so obtained are other than approximate, although, of course, comparisons may be drawn from them when the methods have been applied in strictly the same way in different places. The utmost that sanitarians can at present say respecting the results of experiments of the kind now under notice is that when carbonic acid is shown to be present in excess, and when the source of this impurity is obviously animal respiration, there is every reason to believe that in addition to the known bad effect of this particular compound, the air contains many other objectionable constituents. The proportions of organic matter, chiefly consisting of dust thrown off from the skin and clothing of the occupants, and due to wear and tear of the fittings and furniture of the room, and of living germs of bacteria and spores of vegetable moulds, go with the carbonic acid; for they are formed and and given off with it, and where the gas cannot escape its grosser companions must necessarily remain. If these matters in the air they breathe do not directly poison men, they occupy the room of good air, and tend to clog vital processes, lower vitality, and aggravate any diseased portion of the human respiratory organs which may be

exposed to their influence. One rather disappointing point in connection with this subject of aërial sanitation is that nobody seems to be able to say from positive knowledge whether air in a confined space may be purified as it can certainly be polluted by emanations, gaseous, vaporous, or in the state of dust. When Dr. Ballard investigated the condition of the air of manufacturing districts in which sulphurous acid gas is a regular constituent of the atmosphere, he was unable to make up his mind definitely as to whether any good office in destroying disease germs should be abscribed to this gas in compensation for its otherwise objectionable character. He was obliged to fall back upon the obvious truth that it would be better to have pure than "doctored" air. Acceptance of this dictum does not prevent one from enquiring with some curiosity whether in the case of two rooms equally polluted by the emanations of a crowd of people, the air of one well lighted by gas would be less poisonous than that of another lighted by some other means. It would probably be found that the small proportion of sulphurous acid vapour coming from gas as consumed for lighting, or even from as much sulphur as could be burnt in the room without rendering it uninhabitable, would be without noticeable effect upon the worst pollutions of the air. According to this notion, it must be understood to be much easier to pollute air than to purify it by any means applicable to a confined space. This may be easily credited, notwithstanding the pervasive odour of some marketable disinfectants, which would give anyone disposed to rely upon first impressions to suppose that nothing evil could exist in their presence.

Whatever may be discovered respecting the comparative potency for evil of bacteria, moulds, dust, or other possible ingredients of a foul atmosphere, it is very certain that humanity does better without them, and that the nearer we can approximate our air for breathing to the standard of the pure breezes that chase the cloud-shadows along a grassy hillside or whistle through the cordage of the ocean steamer, the healthier we shall be. There is no possibility of getting very pure air in a town building, however, because the atmosphere of the streets and housetops is itself very highly charged with impurities, except perhaps during, or immediately succeeding a heavy downpour of rain. Yet bad as the outside air may be, the air inside a crowded building must be very much worse; and the more completely and frequently it can be changed the better. The question of how to effect this desirable object is the problem of ventilation. It was brought out by the Dundee and Newcastle experiments that the best ventilation for large buildings—indeed, the only service of the kind worthy the name—is that which is performed by mechanical means; and the purpose of the present article is to suggest that more attention should be devoted to this part of the question. To accept the general proposition of the superiority of mechanically changing the air of large buildings, as compared with attempts in the same direction by the agency of fire draughts, does not carry one very far. Yet even this position is not adopted without great reluctance by those who think that what they call "natural" means should be sufficient for any ventilation. There is some danger in this use of the word "natural," which implies an argument in itself. There can be nothing natural in collecting a thousand people in a lecture-hall almost as tight as a bottle, and expecting the draught-compelling power of a small fire or a few gas-flames to change the air sufficiently for the health and comfort of every member of the audience. The question of draughts is, moreover, of the gravest importance in connection with any system of exhaust ventilation; there being a great and notorious difficulty in ensuring that fresh air shall enter a room by the appointed channels, where such are provided, and not by inconvenient chinks. On the whole, there is obvious sense in the view taken by the partizans of mechanical ventilation, that the atmosphere of a room should be at a slightly but distinctly higher pressure than the outside air, in order that any draughts may be from within outwards, instead of in the contrary sense. A chimney could never smoke where such a law is observed. The next question is: How is mechanical ventilation to be most satisfactorily effected?

We cannot pretend to answer this question in the limits of an article, or to lay down any laws upon the subject. Lightly geared fans, driven at small expense by water motors, have been fairly recommended, and we believe constitute the ventilating system so well spoken of for some of the Dundee schools by Professor Carnelly and his colleagues. On the other hand, a system of this kind, adapted to the Royal Courts of Justice when they were first built, proved a dismal failure; the temperature of the courts varying from that of a slow oven to that of an icehouse, and the condition of the atmosphere being either absolutely torpid and offensive as to odour, or tormented into cross draughts. It is reported, however, that this condition of things has been improved of late by the introduction of the D. C. Green ventilating system, which is credited with being very successful on shipboard. Some engineers speak very highly of this system, which consists in the use of air compressed to from 3 lbs. to 5 lbs. per square inch above the atmosphere. The air compressor is placed in a convenient cellar, and in many places is worked by a small gas-engine. From it small pipes are led to different points of the building, and terminate in nozzles which draw in air from outside by the induced current caused by the escape of the compressed air. Thus not only the compressed air supplies the room to be ventilated, but also the additional bulk of air, about 20 or 30 times its own volume, which this pressure jet entrains with it. The same kind of nozzle, inverted, ejects the foul air when required. The power required to set this body of air in motion is small, because only 5 per cent. of it really passes through the machine. How the system compares in this respect with fans is doubtful; for although with a fan all the air is moved direct, the injection nozzle must require a considerable amount of power to keep it going. In the matters of convenience and efficiency, however, the compressed air system has many advantages. No large shafts for bringing the air are required, the small pipes being easy to take anywhere, and the intake of air may be at any convenient point. It is not the least advantage of this plan that it cures smoky chimneys, and may be used in connection with recuperative gas lighting under the Methven-Sugg system. It is very much to be desired, however, before one can say authoritatively that the Green ventilating system is a great success, that such analyses should be made of the air of a room proposed to be treated as were done by Dr. Bedson and his colleagues at Newcastle; and then, when this record was completed, that comparative costs should be instituted after the new ventilation had been some time in operation. We are not aware that such a crucial experiment as this has yet been made of any ventilation system; and recommend it to the D. C. Green Company as well worth consideration by them. A thorough study of the arrangements for ventilating the Law Courts, with accurate statements of the results, would be a valuable contribution to the literature of aërial sanitation, but a supplement would be necessary giving the results of the same system as applied to a theatre or other building lit by gas.

New England Association of Gas Managers.—The annual meeting of this Association was held at Boston on the 20th ult., under the presidency of the Hon. A. M. Norton. In his address, the President confined himself chiefly to the prospects of the gas industry. He referred to the growing competition of the electric light; stating his belief that the light had "come to stay," and expressing the opinion that the point wherein the industries would chiefly compete would be ultimate improvement in the burner. He looked to see great advance made in the utilization of the energy that is now wasted through want of this development, and thought that the scientific efforts which had, during the past decade, brought the electric lamp to its present state, would cause an equal advance in the gas-burner or lamp, when the problem would be settled. He thought it would be wise for gas companies to offer pecuniary inducement to inventors to improve the means of using gas as an economical illuminant; and gave it as his opinion that the inventors would respond. Advocating the use of electric lighting by gas companies, he saw no hindrances in the way; and said it was plain that the gas company in a town could furnish such light more cheaply than any independent organization. He believed that the sale of gas for illumination would increase steadily, despite any rival agent; but if this should not prove to be true, its sale for purposes of heat and power would more than balance the difference. At the close of the address, the reading and discussion of papers was proceeded with. This portion of the business was varied by a lecture on the "Composition of Coal Gas," by Dr. L. M. Morton, of the Massachusetts Institute of Technology. The President for the current year is Mr. R. B. Taber; Mr. C. H. Nettleton retaining his old position of Secretary and Treasurer of the Association.

An Ancient Reservoir.—The works which the Gas and Water Company of Tunis are now completing are of exceptional interest from an historical point of view; being nothing less than a restoration of the old covered reservoirs of Carthage, which date back fully 2000 years. From the description given in *Le Génie Civil*, it appears that these reservoirs form a block measuring 420 feet long by 89 ft.6 in. broad. The interior is divided into 18 compartments, all of which are in communication with each other and with the incoming and outgoing conduits. During their long existence these cisterns have passed through four periods, alternately of repair and neglect, evidences of which are furnished not only by the different varieties of masonry occurring where repairs have been effected, but also by the character of the various layers of deposit on the walls of the tanks. The first layer of this deposit probably dates back to the time of Hannibal, when the cisterns were in full working order. It is very uniform, and apparently corresponds to a considerable lapse of time; that portion which was first deposited is yellowish, becoming whiter as time went on, and more care was taken with regard to the quality of the water impounded. After the Roman conquest the tanks fell into disuse, and the water in them rapidly became foul; an irregular dark-coloured layer being deposited on the sides. The Emperor Adrian repaired the tanks and impounded in them other waters; and during this period a third layer, pure and white as the first, was deposited. But this state of affairs was put an end to by the irruption of the Arabs in 697. Since that time the cisterns have been entirely neglected; and during this period the fourth layer was deposited, which is similar in all respects to the second. The French Company have practically revived the scheme of the Imperial engineer; and under their auspices the reservoirs will enter upon a new career of usefulness. In cutting through the retaining walls of the cisterns, it was found that these walls were thicker near the ground level than lower down; the reason for this arrangement probably being that the ground was excavated without any arrangement for keeping the sides of the excavation vertical, and the space between the earth slope and the true vertical line was filled in solid with masonry instead of soil.

Communicated Articles.

CLASSIFICATION OF COAL UNDER THE RAILWAY AND CANAL TRAFFIC ACT, 1888.

By J. Ferguson Bell.

Engineer and Manager of the Stafford Corporation Gas-Works.

The Railway Companies have recently issued their proposed new classification of merchandise traffic and revised schedule of maximum rates and charges under the Railway and Canal Traffic Act, 1888. An inspection of the rates now charged for the carriage of coal and the new rates submitted to the Board of Trade, will at once show the immense importance of this revised classification to all gas companies and corporations owning gas-works.

The revised classification divides traffic into three sections—A, B, and C; the sections A and B being for four tons or upwards, and C, for two tons or upwards. The merchandise comprised in classes A and B, if sent in quantities of less than four tons and not less than two tons, are classed in section C. The traffic is further divided for lots of less than two tons into five sections, numbered 1 to 5 inclusive. All merchandise classed in these sections is subject to rates according to classification, beginning with A, which is the lowest; the last and highest section being No. 5, which includes glass and chemicals, also articles not specified in any of the sections.

Class A in the revised classification is applicable to consignments of four tons or upwards for the following goods:—Cannel, coal, coke, culm, cinders, ironstone, slack, iron ore, slag or scoria (blast-furnace). This class is the one in which the interests of gas companies are chiefly concerned; and I will therefore confine myself to showing the enormous increases in the proposed new maximum rates as compared with the present. To enable me to make this comparison, I have obtained the rates now charged for the carriage of gas coal in twelve towns so situated that they embrace the principal railway companies, and have calculated the new rates from the proposed schedule of charges. Before giving them, however, it may be as well to give the following table, which shows the different rates proposed by the various railway companies (for they have not agreed among themselves as to their charges:—

Class A.—*Rates for Gas Coal, Cannel, Coke, &c.*

	Proposed Maximum Rate for Conveyance per Ton per Mile.						Proposed Station Terminal at each End, per Ton.	
	For any Distance not exceeding 50 Miles.	For any Distance exceeding 50 Miles.	For the first 10 Miles.	For the next 20 Miles.	For the next 20 Miles.	For the Remainder of the Distance.	At Large Towns.	At any other Station.
	d.	d.	d.	d.	d.	d.	d.	d.
London and North-Western Railway .	1	¾	..	..	..	..	8	6
Lancashire and Yorkshire Railway .	1	¾	..	..	..	..	8	6
Midland Railway	..	..	1¼	1¼	¾	½	8	6
Great Northern Railway	..	..	1¼	1¼	¾	½	8	6
North-Eastern Railway	..	..	2	1	..	¾	6	6

The rates given in the statement are from the four principal coal-fields to London, Birmingham, Bristol, Leicester, Northampton, Rugby, Wolverhampton, Stafford, Burton, Oxford, Shrewsbury, and Exeter. I have indicated the towns mentioned by the letters A to L, and may add that they are not in sequence, for obvious reasons. The rates and mileage must be taken as approximate; but I think that in the majority of cases they will be found to be correct—at least they are quite accurate enough for comparison. When the railway company allow a rebate, it is deducted from the quoted rate; no charge for wagon hire being included in any case. The new rates are calculated on the mileage, and terminals added according to the maximum rates as now submitted to the Board of Trade under the revised classification of merchandise traffic:—

Statement of Present and Proposed Rates for Carriage of Coal.

Towns.	South Yorks. Collieries.			North Staffs. Collieries.			Wigan Collieries.			North Wales Collieries.		
	Mileage.	Present Rate.	Proposed New Rate.	Mileage.	Present Rate.	Proposed New Rate.	Mileage.	Present Rate.	Proposed New Rate.	Mileage.	Present Rate.	Proposed New Rate.
	Miles.	s. d.	s. d.	Miles.	s. d.	s. d.	Miles.	s. d.	s. d.	Miles.	s. d.	s. d.
A	65	4 9	6 5	20	2 0	2 8	63	2 6	5 0	62	2 11	4 11
B	75	4 3	6 10	36	3 0	4 0	79	3 4	5 11	78	3 9	5 11
C	68	4 6	6 6	48	2 7	5 0	91	4 0	6 9	90	4 2	6 7
D	76	4 6	6 10	66	3 11	5 3	112	4 6	8 0	111	4 1	7 11
E	54	..	6 0	72	3 0	5 6	120	4 3	8 6	119	5 1	8 5
F	80	5 3	7 1	82	4 6	6 2	128	4 9	9 0	127	5 0	8 11
G	136	6 4	9 4	124	6 3	8 9	170	6 3	11 7	169	5 7	11 6
H	157	8 3	10 3	146	6 6	10 2	194	7 0	13 1	193	..	13 0
I	44	4 0	5 5	52	2 10	4 3	98	..	7 2	95	3 11	6 10
J	95	6 3	7 8	46	3 5	4 10	70	5 3	5 4	35	..	3 11
K	160	5 9	10 4	138	5 9	9 10	186	6 0	12 8	160	5 3	11 0
L	238	10 4	13 8	216	8 9	14 6	264	..	17 6	238	9 3	15 10
Average cost per ton.	For one mile.	0·65d.	0·93d.	For one mile.	0·60d.	0·93d.	For one mile.	0·47d.	0·84d.	For one mile.	0·47d.	0·85d.

The anomalies in the existing rates are apparent; but by taking a large area, which includes the principal companies' lines, we get a fair average cost per mile, which I presume is a remunerative rate, for all the companies pay fair dividends, and their stock generally stands considerably above par. The present average rate per mile for the carriage of gas coal and cannel from the four principal coal-fields, according to the above statement, being 0·55d. per ton, against the new maximum rate now proposed of 0·89d. per ton per mile (the terminals being included in the rate per mile), the increase amounts to 0·34d. per ton, or over 60 per cent.

Why should the railway companies seek to be empowered to charge rates on gas coal, or any other traffic, more than half as much again as their present tariffs? Further, the proposed terminal charges of 6d. or 8d. per ton at each end are simply preposterous, especially in the case of section A, where the minimum quantity is a lot of four tons. All traffic under this section only requires siding accommodation, and no warehouse room or labour in handling; and I venture to affirm that the present charge of 8d. per ton for terminals is ample. No doubt the specious argument of the companies will be, that the rates proposed are maximum, and that they do not necessarily intend to charge them. Well, from experience, we know that where no competition exists excessively high rates are the rule, of which innumerable cases could be cited; and I find, when comparing the rates of the towns named, that favourable rates now generally only exist at points where there is competition.

It appears to me to be the duty of all who have gas undertakings under their control to look well into this matter, for we cannot afford to let the opportunity slip. Certainly some united action should at once be taken, for representation must be made to the Board of Trade within eight weeks from the date of the first advertisement of the proposed classification (the 19th prox.), in order to have any avail.

THE CHEMISTRY OF ILLUMINATING GAS.

By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.

X.

The nature and properties of the "sulphur compounds" in coal gas remain to a great extent a matter of conjecture. The only "sulphur compound," other than sulphuretted hydrogen, that has been proved by chemical tests to be present is bisulphide of carbon; and for some time this substance was regarded as constituting the "sulphur compounds." It is now known that, in addition to bisulphide of carbon, sulphur exists in other forms to the extent of 6 or 8 grains per 100 cubic feet in the gas.* The bisulphide can be entirely removed by washing the gas with weak ammoniacal liquor; but purification in this manner will not render the gas free from sulphur. As will readily be understood, the very small proportion renders it impossible to collect a sufficient quantity of "sulphur compounds" for examination by the methods usually applied in the study of the properties of gases; and the mode by which they are quantitatively determined is merely

* See Gasch's experiments, Journal, Vol. XXII., p. 599.

an inferential one. In order to arrive at any ideas of their nature, therefore, the only method is to examine the properties of such substances as are likely to be formed under the ordinary conditions of coal distillation for the manufacture of gas. This it is proposed to do, but in a very brief manner, as further reference to the subject will be made under the head of "Purification and Illuminating Gases."

An announcement was made in 1857,* that M. Baudrimont had discovered the existence of a sulphide of carbon, having the composition of CS, and therefore analogous to carbonic oxide. It was produced by passing carbon disulphide in contact with inert material—such as pumice stone—at a red heat; or by the action of hydrogen on carbon disulphide, or of carbonic oxide on sulphuretted hydrogen, at a high temperature. Either of these reactions might take place during the production of gas from coal. It is gaseous, soluble in water, and absorbable by alkalies; so it should be readily removable in the washers or purifiers. As much, however, may be said in regard to all the suggestions as to the constitution of the so-called sulphur compounds. They are all either soluble in water or in a solution of sulphide, or removable by alkalies. One result of the absorption of carbon sulphide is the formation of an equivalent of carbonic oxide, which would, of course, remain in the gas; and it is possible that the formation and subsequent decomposition of this compound is one of the sources of the carbonic oxide that is always present in small proportion in coal gas. Hofmann† tried some experiments with respect to the sulphur compounds in 1859. The average of four experiments in July gave 7¼ grains; and a similar number of tests taken in December and January showed the presence of 10 grains of sulphur per 100 cubic feet of gas. He also shows how the presence of carbon disulphide can be qualitatively indicated. In 1872, two lectures on the subject were delivered by Dr. Odling,‡ and Mr. Wills§ respectively, from which it is evident that at this period the only "sulphur compound" that had been directly proved to be present was carbon bisulphide. In the same year Mr. A. G. Vernon Harcourt lectured before the Society of Arts on the sulphurous impurity in gas and the means of removing it; but did not advance any additional information in regard to the actual nature or constitution of such impurities. Dr. Letheby, in a lecture delivered before the British Association of Gas Managers in 1865,‖ remarked: "There is good reason for concluding that sulphur exists in coal gas in other forms than as sulphuretted hydrogen and bisulphide of carbon;" but he gave no further particulars. An interesting series of articles on "Sulphur in Coal Gas" by a writer under the *nom de plume* of "Delta" appeared in the JOURNAL in 1879,** in the course of which several reactions that might obtain in the retorts, resulting in the formation of complicated sulphur compounds—such as the sulpho-carbonate, sulphocarbamate, and sulphocyanide of ammonium, oxysulphide of carbon, &c.—are quoted.

Failing more satisfactory or definite information, we turn to the results known to be secured by the combustion of the gas. These are simply the plain fact that sulphur in some form or other, in the minute proportion already indicated, escapes the purifying apparatus, and passes on with the clean gas; and that it may be detected by applying appropriate chemical tests and processes to the products of combustion. For many years a marked disagreement was observable between the results obtained by various operators; and it was not until the matter was taken in hand and exhaustively investigated by the London Gas Referees, that satisfactory results were obtained. Sulphur tests are taken daily in London; and periodically in most of our chief towns. They have been published in the form of regular returns; and the conclusion to be drawn from these documents is that the difficulty of keeping down the sulphur compounds is increased according to the volume of gas dealt with. In small towns, no difficulty arises in keeping them within reasonable limits, provided modern purifying plant of ample capacity is used; but at the largest gas-works in the country, considerable difficulty has arisen. It is also notorious that the proportion present varies with the rate of manufacture; being lowest in the summer, and highest during the months of January and December, at the time of heaviest consumption. This seems to indicate that the "sulphur compounds" consist of various substances, traces of which have escaped the purifying apparatus; and that they may be substantially reduced by enlarging the existing plant. On account of other considerations, it is now usual to employ larger purifiers, washers, and scrubbers, than were used 10 or 15 years ago; and thus a movement is made in the direction of such a state of affairs as obtains at the small works. The velocity of gas through the apparatus is lessened; leaving a longer period of time for contact with the purifying material. At a small gas-works the quantity of gas dealt with per unit of purifying surface—we may take a square foot area, or any other measurement as indicating that unit—is necessarily less than that which obtains at larger works; and this fact explains how it is that the sulphur compounds are more easily dealt with on the small scale and in the summer than in winter and on the large scale.

Although a great deal has been written and said, although experiments without end have been tried, and numerous parliamentary and other inquiries have been held, it cannot be claimed that any really decisive information is obtainable as to the influence or effect of these sulphur compounds. All the evidence is of a circumstantial nature. We know that the presence of sulphur in gas can be proved; we know that under certain circumstances—such as the presence of a cold metal surface to act as a condenser—drops of oil of vitriol are to be found in the vicinity of gas-flames that have been in use for a very long time; we know that book-covers, textile fabrics, gilding, &c., after lengthened exposure to the products of gas combustion, become rotten, tarnished, and injured. But all this is no direct proof that the gas-flame is really the culprit, for it cannot be taken as incontestably proved that the injury is due to sulphuric acid. Perhaps the heat and dryness of the air, due to want of proper ventilation, may be the cause. It has not been decisively shown that the whole, or any considerable portion, of the sulphur present in the gas is converted into sulphuric acid when burnt under the usual conditions. And lastly, assuming the presence of sulphuric acid to be proved, the conclusion that the whole of it comes from the gas is not warranted. We want to know how much of it comes from gas, and how much from other sources.

The sulphur is generally supposed to be found in the products of combustion in one of two forms, either as sulphurous acid or as sulphuric acid. The bulk of the very large mass of evidence available goes to show that, under ordinary circumstances, it is evolved as sulphurous acid. This point was very fully inquired into in 1877. The Gaslight and Coke Company and also the Crystal Palace Gas Company applied to Parliament for relief in the matter of the sulphur clauses, which enforced penalties if the proportion of sulphur present exceeded a certain limit. They were opposed by the local authorities; and the result was a very long inquiry before the Parliamentary Committee.* A great deal of scientific and other evidence was given on both sides; the expert witnesses including Drs. Odling, Frankland, and Meymott Tidy, Messrs. C. Heisch, T. W. Keates, F. J. Evans, F. S. Barff, W. C. Young, Vernon Harcourt, A. Ellissen, &c. The reader may be referred to the evidence for full information on this point. It is too long to be even briefly summarized here; but it may be stated that its general tenor went to show that the products from ordinary burners rarely contained sulphuric acid. If the gas was burnt under special conditions, as in the Referees' sulphur test, where a very small jet, much smaller than any used in practice, is burnt in an atmosphere charged with ammonia, any proportion of sulphuric acid up to the total sulphur present could be obtained.†

Sulphurous acid is volatile, and so feeble as to be practically a non-corrosive acid when diluted; so that if it could be assumed that the sulphur from the gas escaped in this form from the apartments, no harm would ensue. But sulphuric acid is non-volatile at ordinary temperatures. A very weak solution of it, exposed to the air, becomes concentrated by reason of the evaporation of the water. It is well known by those who are in the habit of dealing with this substance, that a drop of the solution, no matter how weak, spilt upon textile fabrics, will "burn" a hole. The position of the "sulphur question" is therefore influenced to a great extent by the form in which the sulphur is produced; whether it passes off as the comparatively harmless sulphurous acid, or remains in the room as the corrosive sulphuric acid. On behalf of the gas companies it has been shown that the former condition obtains; but on the other side it has been just as strenuously contended that, if sulphurous acid is formed at all, it is rapidly oxidized into sulphuric acid. But if we admit that the whole of the sulphur is converted into sulphuric acid, the quantity is so small that with proper ventilation it will pass out with the other products of combustion. This view of the case has been met by what is called the "cumulative theory," which may be briefly stated as follows:—After the gas has been burning for some time, the upper strata of air in the room become charged with heat and products of combustion. When the gas is put out, this heated layer gradually cools, and deposition of moisture takes place. How this should follow will readily be understood from the explanations already given with regard to water vapour in relation to the atmosphere at ordinary temperatures. This very fine rain carries down with it a little sulphuric acid—very little it is true—and the process, being repeated day after day and month after month, causes a sufficient accumulation of sulphuric acid to produce the effects complained of. Such a condition of things can only take place where the ventilation is miserably defective. If the air in the upper part of a room is allowed to get heated to the extent of 20° or so above atmospheric temperature, and to remain in that condition for several hours, leather or textile fabrics exposed to it may reasonably be expected to become dry and rotten after a time. Rendering gas absolutely free from sulphur, moreover, would not remedy the trouble, because the sulphuric acid present in the air from other sources would be deposited; and indeed, if we admit this ingenious theory, it does not follow that the infinitesimal dose of sulphuric acid is entirely due to the gas.

Whether the heat from the gas at all favours the oxidation of sulphurous acid, in the presence of moisture, is an important point, which was exhaustively investigated by Mr. Harold B. Dixon in 1881.‡ The conclusion arrived at, after many experiments, is "that sulphurous acid is unoxidized in a damp atmosphere so long as the temperature is maintained above the dew-point. The sulphuric acid found in a gas-lighted room is formed by the oxidation of hydrogen sulphite, which is first produced by the solution

* See JOURNAL, Vol. VI., p. 411. † *Ibid*, Vol. IX., p. 458.
‡ *Ibid*, Vol. XXI., p. 696. § *Ibid*, p. 850.
‖ *Ibid*, Vol. XIV., p. 510. ** *Ibid*, Vol. XXXIV., p. 506 *et seq.*

* These proceedings were fully reported in the JOURNAL, Vol. XXIX.
† For further information as to the effects attributed to "sulphur compounds" in gas, see JOURNAL, Vol. XXIV., pp. 22, 573, and 856; and Vol. XXXVI., p. 925, &c.
‡ See JOURNAL, Vol. XXXVII., p. 704. Also *ibid*, pp. 97, 185, 216.

of sulphurous acid in water condensed on cold and hygroscopic surfaces; or sometimes, it may be, in water precipitated in the form of a cloud by cold draughts cooling the air locally below the dew-point."

From these considerations it is evident that the effects alleged to be due to the sulphur compounds are not likely to be experienced so long as proper ventilation is provided. If goods are stored away in the upper part of rooms in which gas is continuously used, and occupied by human beings also, and at the same time this part of the room is not ventilated in any way, they are exposed to foul air sometimes hot and dry, sometimes cold and damp, which cannot but be injurious to them, apart from any question of sulphuric acid. The upper part of most rooms is simply a sort of inverted box. There is no outlet in the ceiling, or perhaps for a distance of 2 feet or so down the walls; and even at lower points, the ventilation is left to accidental circumstances—cracks and crannies, occasional openings of doors and windows, the chimney draught, &c. The effect is that the foulness, which ought to pass away freely, is retained as long as possible. Once provide proper ventilation on the lines indicated in the previous part of this paper, so that the atmosphere in every part of the room can be retained in a wholesome condition, and nothing will be heard about the "sulphur" from coal gas; and but for gross neglect of this important matter, nothing ever would have been heard about them. I do not say that the gas should not be rendered as pure as possible; but the primary consideration is *proper ventilation*.

Technical Record.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Nineteenth Annual Meeting of this Institution was held on Saturday, the 2nd inst., at the Technical School, Princess Street, Manchester. The PRESIDENT (Mr. T. Duxbury, of Darwen) occupied the chair. He offered the members a cordial welcome, and remarked that, as this was the annual meeting, the Committee deemed it better to confine the programme strictly to business matters, instead of entering on anything like the discussion of papers. They had one paper still to discuss—that which was presented by Mr. T. Newbigging at a former meeting; but they thought it advisable to wait until the next meeting for the consideration of it.

The HONORARY SECRETARY (Mr. Harrison Veevers, of Dukinfield) read the minutes of the meeting held at the Victoria Hotel, on Saturday, Dec. 1 last; and these were confirmed, on the motion of Mr. J. DALGLIESH (Glossop), seconded by Mr. W. W. HUTCHINSON (Barnsley).

ANNUAL REPORT AND ACCOUNTS.

The HONORARY SECRETARY then read the Annual Report of the Committee, which was given in the JOURNAL last week (p. 432).

The PRESIDENT observed that the members had had copies of the balance-sheet; and he did not think it need be read.

Mr. ISAAC CARR (Widnes) asked if there had been any increase in the expenditure on excursion meetings? The amount in the balance-sheet was £14 5s. 5d. He did not know whether this was a greater or less sum than last year; but it was very unsatisfactory to see a deficiency, and though the explanation in the Committee's report had partly disposed of it, he should like further information.

The HONORARY SECRETARY said the expenses of the excursion as given in last year's balance-sheet were £10 2s. 7d. The meeting at Northwich was rather an expensive one; but he believed the members were amply repaid.

Mr. CARR thought that if the expenses were increasing, it would be better to raise the subscription than allow a deficiency to accumulate, because the Institution must be self-supporting.

Mr. T. B. BALL (Rochdale) said it would be all right if the members would pay up their subscriptions; for this would give them a balance of £7 7s. to the good.

It was also pointed out that an extraordinary item of expenditure—£3 15s. for a box for the Institution's documents—would not occur again.

Mr. CARR: But we do not know what else will occur.

Mr. BALL remarked that last year there were 5½ guineas of subscriptions paid in advance. This year there were 14½ guineas in arrear. This made a difference of £21. When last year's subscriptions were paid up, there would be ample funds to meet their liabilities.

Mr. CARR said it would be satisfactory to him if they had the balance on the right side.

The PRESIDENT did not think there was any need for increasing the subscription. The Institution did not exist for the purpose of making profit; and if they could pay their way, it was all they required.

Mr. W. W. HUTCHINSON (Barnsley) moved that the balance-sheet and report be adopted. The adverse balance was, he said, more apparent than real. If the subscriptions in arrear were paid, it would be all right at once.

Mr. CARR seconded the motion; and it was carried.

ELECTION OF OFFICERS.

Mr. D. CLARKE (Ashton-under-Lyne) proposed that Mr. W. W. Hutchinson be elected Senior Vice-President. He was sure the nomination would be received with very great pleasure; for Mr. Hutchinson's services to the Institution had been great, and they had done him much credit. He was most energetic in everything he undertook; and the duties of the various offices he had undertaken had been fulfilled in such a manner that he had no hesitation in proposing him for this office.

Mr. ISAAC CARR (Widnes) had great pleasure in seconding the proposition. Every member was aware of the great work which Mr. Hutchinson had performed from time to time on behalf of the Institution; and it was only a very slight return for what he had done to elect him to this honourable position. He would fill the office of Vice-President, and, when the time came, that of President, with the same ability as he had that of Secretary.

The PRESIDENT entirely concurred in what had been said. He did not think there would be any difference of opinion in electing Mr. Hutchinson to this office.

The resolution was carried by acclamation.

Mr. HUTCHINSON, in returning thanks, said he could not fill the office as he should like; but he would endeavour so to do it as to give the members satisfaction. He should endeavour to do his best in reference to all the duties that pertained to the office.

The PRESIDENT said the next position to fill was that of Junior Vice-President. One or two gentlemen who were thought eligible, had removed from the district; but the Committee had selected names for all the various positions which would be submitted to the members.

Mr. T. B. BALL (Rochdale) moved that Mr. T. O. Paterson, of Birkenhead, be elected Junior Vice-President. He had had some acquaintance with Mr. Paterson, and was very glad to be able to nominate him to this office. Mr. Paterson was a gentleman occupying a position of responsibility, and was in every respect well qualified for the office, and they would do themselves a good turn in appointing him.

Mr. W. WOODWARD (Bury) seconded the resolution. Mr. Paterson was a worthy son of a worthy father; and he would be of great use to the Institution.

The resolution was carried.

Mr. PATERSON thanked the members for the honour they had conferred on him, and the mover and seconder of the resolution for their kind remarks. He should forward the interests of the Institution so far as lay in his power.

Mr. J. DALGLIESH (Glossop) said he had to submit a name for the position of Treasurer which would be acceptable to every member of the Institution. It was that of their esteemed friend, Mr. T. Newbigging, of Manchester. Great credit was due to him as one of the founders of the Institution, and as one who had done much for it; and while they had him in their midst, they might congratulate themselves that they possessed in the Institution one who was both an able engineer and a true and worthy friend.

Mr. HUTCHINSON seconded the resolution, which was adopted.

Mr. NEWBIGGING said he was much obliged by this renewed mark of the members' confidence. He did not know whether they would propose him a vote of thanks; but if they did, it would certainly be the first time he had deserved such a compliment, because he had advanced the small balance on the debit side of the account. He hoped, however, that subscriptions would be paid up promptly, and this adverse balance would not then be seen in the next balance-sheet.

The HONORARY SECRETARY said the duty now devolved upon him of nominating his successor. He had held the office of Secretary for twelve months; and the work which, under other circumstances, would have afforded him the greatest gratification, had, owing to the multiplicity of his duties, been a task rather than a pleasure. This being so, he should be unable to continue to discharge the duties of the position, even if they were kind enough to elect him. It would be a good thing if the office were conferred on a younger man. Old age and secretaryships did not agree; and he had, therefore, pleasure in proposing that Mr. S. S. Mellor, of Northwich, be appointed to the post. The members must have noticed on their visit to that town last summer how well Mr. Mellor worked for them, and how attentive he was; and this gave him (Mr. Veevers) the idea that he would make an excellent Secretary of the Institution.

The PRESIDENT remarked that the office was no sinecure. As Mr. Veevers had told them, it involved a great amount of work; and they wanted someone who could attend to it properly.

Mr. HUTCHINSON thought that, as the Secretary who immediately preceded Mr. Veevers, it would be only right for him to second this resolution. He did so with great pleasure, because he believed the gentleman named would discharge the duties satisfactorily. He quite agreed with Mr. Veevers that it required someone with time at his disposal to attend to the business.

The resolution having been carried,

Mr. MELLOR briefly expressed his thanks.

The next business was to elect two members of the Committee to fill the vacancies caused by the retirement of Messrs. Miles and Chester.

Mr. J. BRADDOCK (Radcliffe) proposed that Mr. Joseph Timmins, of Wigan, be elected as a member of the Committee. Mr. Timmins, he said, occupied a very important position, and was so well known that any recommendation of him was superfluous.

Mr. PATERSON seconded the motion.

Mr. ISAAC CARR proposed, as an amendment, that Mr. Varley, of Colne, be elected to the office. Mr. Varley was an old member of the Institution. In choosing Committeemen, it was necessary to recognize the conduct of members in the past. He had seen Mr. Timmins's name in the list of members for a great

number of years—ever since he had been connected with the Institution, in fact; but he had never yet seen that gentleman's face to his knowledge. He made a point of attending most of the meetings of the Institution; and he did not know that he had ever seen Mr. Timmins at one of them. This being so, he was at a loss to understand what was the object in proposing a gentleman who took absolutely no interest in conducting the affairs of the Institution; and he therefore proposed the name of Mr. Varley.

Mr. W. Woodward (Bury) seconded the amendment. Like Mr. Carr, he had never seen Mr. Timmins; and he had never been at a single meeting which Mr. Varley had not also attended.

Mr. Hutchinson asked how long it was since Mr. Varley was a member of the Committee. So far as his recollection went, it was not long since Mr. Varley served on the Committee; while, as to the statement that Mr. Timmins did not attend, he had personally seen him at sundry meetings.

Mr. F. Timmins (Wigan) observed that it was true he had not attended the meetings very frequently during the last few years, in which he had been hard pressed with business; but certainly Mr. Carr was wrong in saying that he had not been to any meetings the last six or seven years. He thought, however, it would be better if he withdrew his name.

The President hoped he would not do so. Two members were required; and both Mr. Timmins and Mr. Varley could be elected. He had frequently seen Mr. Timmins present at the meetings—perhaps not so often as some other members; perhaps not so frequently as Mr. Carr. Still he (the President) endorsed the opinion already expressed, that he would make an excellent member of the Committee. In saying this, he did not, of course, intend any disparagement of Mr. Varley.

Mr. Carr explained that Mr. Varley was, on a former occasion, a member of Committee for twelve months only; and then, through a little irregularity or some alteration in the rules, he retired. He had never yet filled the office for the full term.

Mr. Veevers suggested that Mr. Varley should be elected to the second place.

Mr. Varley sincerely hoped that no vote would be taken upon the matter. Personally, he was quite satisfied with the nomination of Mr. Timmins.

Mr. Veevers added that Mr. Carr was not a member of the Institution during the early part of Mr. Timmins's connection with it; and he was not present at meetings during the six years that Mr. Timmins was. He had attended the meetings; and though he had not taken an active part in the affairs of the Institution, he had been no less anxious for its welfare. Personally he had known Mr. Timmins for a great number of years; and he had great admiration for his quiet, unobtrusive character. Mr. Timmins was his nomination to the Committee; and he hoped he would be elected. He occupied a very prominent position as the Engineer and Manager of the gas-works of one of the largest boroughs in Lancashire; and the Institution would not be disgraced by having him as one of its members. If there was any desire to elect another gentleman, he hoped he would be elected, not in substitution of Mr. Timmins, but in company with him.

Mr. Woodward believed the remarks of Mr. Carr were, like his own, offered with no personal feeling, but simply with reference to the recent attendances of Mr. Timmins.

Mr. Carr hoped that Mr. Timmins, whom he now saw for the first time in his life, would not take his words unkindly in any way. His objection was not a personal one, but to the principle of putting a man in office who took no active interest in conducting the affairs of the Institution. If Mr. Varley withdrew his name, he should move another, because he thought it the duty of the members to elect those who took an interest in the Institution.

Mr. Varley begged to withdraw his name.

Mr. Timmins also withdrew his name.

The President remarked that it was very unfortunate this should be so. He was sure Mr. Carr did not mean any disrespect to Mr. Timmins; but simply that he had not seen him at the meetings. He (the President) knew he had attended, and felt sure he would make an excellent member of the Committee. He could not occupy the position he did, and could not have been so successful as he had been in that, and his previous post, without having the ability to serve the Committee and the members of the Institution. He would say the same as regarded Mr. Varley, for he did not want to place the one against the other. They required two members of Committee. If Mr. Carr had another name to propose, he was within his right in proposing it.

Mr. Carr proposed the name of Mr. Braddock.

Mr. J. Parkinson (Brighouse) seconded the proposal. It had been said—and he had often heard the remark—that the Institution was ruled by a clique. They had either to be Freemasons, or they must come to Manchester on a Tuesday if they wanted office. This was an opinion he had often heard expressed. He thought old members of the Institution should be put on the Committee; and he had great pleasure in supporting the nomination of Mr. Braddock, seeing that Mr. Timmins had withdrawn his name.

Mr. Braddock said he had been on the Committee, and had also served for one or two years as Secretary. In proposing Mr. Timmins, he had the idea that he was a prospective President; and he thought that this point should be borne in mind, rather than simply the question of the greatest number of attendances. He did not think himself adapted for a position of this character, and should very much prefer on this occasion to withdraw his name from the list of candidates.

Mr. Veevers, as a very old official of the Institution—he was its third President, and had been both Treasurer and Secretary—challenged anybody to say that he ever served the Institution for any mercenary or cliqueish motive. As for anything in connection with Freemasonry, this was the first time he had heard of it. In governing the Institution, it had been found that those who lived a great distance off were rather poor attenders at Committee meetings. Some, indeed, had only been present once during a year. The selection had therefore to some extent been made from those near Manchester; but he desired most earnestly to disabuse the mind of the members of the idea that they had any cliqueism in connection with the Institution from any mercenary or other motive.

Mr. Ball said he was a living refutation of Mr. Parkinson's allegation. He was not a Freemason, and he never visited Manchester on a Tuesday; and as he was the prospective head of the Institution, he thought this was a sufficient answer to the assertion which had been made. The only possible motive the Committee had in suggesting names was that they might not sit at the meetings looking at each other waiting for nominations to be made. If the names which the Committee suggested did not meet with the approval of the members, they had no desire to press them. They thought, as a Committee, that the gentlemen whose names they selected were likely to be useful to the Institution; and on this ground, and that alone, they suggested their nomination. Some regard was, of course, had to the length of time which had elapsed since they joined the Institution. They considered they should look to some of the older members before going to the younger ones; but beyond this, they had no interest in the matter whatever. He regarded the remarks which had been made as very unfortunate; inasmuch as it looked as if there were some division among them, which scarcely could be said to be the case.

Mr. Carr hoped it would not be thought that he had any feeling of hostility to the Committee, or those whose names were mentioned. He said what he had to say simply in the interest of the members. [Mr. Ball: Quite so.] They were asked to elect members of the Committee; and he proposed the names of those he considered most fit.

Mr. Newbigging thought they should all be very careful about making such gratuitous and uncalled-for remarks as Mr. Parkinson had that day. What had been said had quite hurt his feelings. He did not know that there was such difference of opinion in the Institution; and as for its affairs being managed by a "clique," what ground was there for such a charge as that? Did they not change their President every year? Did they not change their Secretary almost every year? And did they not elect two or three members of the Committee every year? He believed he was the only permanent official there was. He had been inclined that day to ask them to elect another Treasurer, because he did not care for his name to come before them year after year as the holder of the position. He refrained, however, from suggesting a change, as the balance was, unfortunately, on the wrong side; and it might be thought he was running away from the post. But such a gratuitous and uncalled-for remark as they had heard was positively unfounded, and would do the Institution a great amount of harm. He hoped Mr. Parkinson would apologise for it. He (Mr. Newbigging) was not a Freemason—he had never had time to be a Freemason; and as for meeting each other on Tuesdays, what did it mean? Tuesday was his busiest day; and he was in his office generally until six or seven o'clock at night on that day. He hoped the person making the remark in question would, on consideration, apologise for it.

Mr. Hutchinson considered it was better that they should hear of it if any feeling of the kind hinted at did exist in any quarter. He should, however, like to give his testimony, as one possessing a considerable knowledge of the Institution, to the fact that there was no foundation whatever for the statement.

Mr. Timmins thought, as one who was named for a position on the Committee, he ought to add a word. The remark of Mr. Parkinson seemed to insinuate a great deal; for it was addressed not only to the members present, but to the outside public. Mr. Parkinson said that gentlemen were elected to posts of honour in the Institution simply because they were Freemasons, or because they attended Manchester on Tuesdays. Well, he could emphatically state that he had never been to Manchester on Tuesday afternoons; and Mr. Parkinson had certainly never seen him there. He believed it was only fair he should state this; for he did not wish it to be thought that he attended any meetings on Tuesday afternoons. With Mr. Newbigging, he considered that an apology ought to be made for such remarks.

Mr. Parkinson said that if he had hurt the feelings of any member, he must apologise. He was, however, glad that the late Secretary (Mr. Robert Hunter, of Chester), had just come into the room. Ten years ago that gentleman remarked, at one of their meetings, that it was often said the Institution was worked by a clique; and he (Mr. Parkinson) had frequently had it remarked to him. He had simply repeated what he had been told—viz., that it was worked by a clique. He had no evidence that it was so; but it had been said, and he repeated it in the interest of the Institution. If it was not so, he had no evidence of it, and he begged to withdraw what he had said.

The President reminded the meeting of the position of affairs. Mr. Timmins had been proposed as a member of the Committee. Mr. Varley was also proposed; but he withdrew his name, and, in substitution of it, Mr. Carr nominated Mr. Braddock. Both Mr. Timmins and Mr. Braddock wished to withdraw; but he hoped neither would take the remarks which had been made as applying

to him. Personally he knew nothing of any cliqueism; and he had never known Freemasonry or anything else brought in as a qualification. The Institution held one meeting at the Freemasons' Hall, which it was thought would be a convenient meeting place. Some members, however, objected to it, and they had not met there since. They had been all over Manchester to find a good meeting-place. They did not want to go to an hotel or the Freemasons' Club, or anything of that kind; they desired to get on to absolutely neutral ground, and they had some trouble in obtaining a suitable place. He was glad that Mr. Parkinson had withdrawn his remark; and he was also pleased to find there was no foundation for it. If it was only based on something which he heard said ten years ago, he did not think they need care anything about it. There were two names before the meeting; and they could, if they pleased, elect both Mr. Timmins and Mr. Braddock. The latter gentleman had been on the Committee, and had served as Secretary. He did not think it wise to re-elect members of the Committee. Their reason for suggesting names was to get men who lived near Manchester; and if they could do this, they would accomplish the object they had in view. If there were no other names, they might elect the two gentlemen named. Mr. Timmins, he might just say, had been a member of the Institution for thirteen years.

Mr. CARR asked if they proposed to elect the two gentlemen named to the two vacant positions.

The PRESIDENT replied that the Committee did not propose to elect anyone; it was for the members.

Mr. CARR wished to know whether the two names were to be put together.

The PRESIDENT said the question before the meeting was that of electing one member; but it became a question whether they should not fill the two posts by the election of the two gentlemen named.

Mr. BRADDOCK thought his name ought not to be put to the meeting after he had intimated his desire to withdraw.

The PRESIDENT remarked that they had had a similar request from Mr. Timmins.

Mr. HUTCHINSON said he could understand the feeling that had been excited. The Committee would prefer the nominations should come from the general body of members in every case; but as they were charged with the conduct of the affairs of the Institution, it was necessary to provide some names, so that the meeting might not be committed to the election of quite new members, while older members were overlooked.

Mr. DALGLIESH trusted that Mr. Timmins would be induced to stand. He would make a valuable member of the Committee.

The PRESIDENT took it that they still had the names of Mr. Timmins and Mr. Braddock before them. If there was no other nomination, they would take a vote on these two.

Mr. BRADDOCK said he must positively decline to fill the office.

The PRESIDENT was aware that Mr. Braddock had expressed a similar feeling on previous occasions. They had now, therefore, only one name—that of Mr. Timmins; and he would submit that to the meeting.

Mr. Timmins was then elected, with only one or two dissentients.

Mr. CLARKE proposed that Mr. Woodward should be elected to the other vacant position on the Committee.

Mr. CARR seconded the proposition. He believed Mr. Woodward would attend well to the interests of the Institution. He was a constant attender at the meetings, and had the interests of the Institution at heart, and would be a very useful official.

Mr. Woodward wished to withdraw his name; but the mover and seconder declined to permit this, and the resolution was carried unanimously.

On the motion of Mr. CLARKE, seconded by Mr. R. HUNTER, Messrs. W. Smith, of Hyde, and J. Mackenzie, of Wilmslow, were elected Auditors.

THE NEW AND THE RETIRING PRESIDENTS.

The PRESIDENT said his duties in the chair were about terminated; and all that remained for him to do was to introduce his successor. Before doing so, he desired to thank the members very heartily for the cordial support he had received at their hands during the past year. He had been received kindly, treated considerately, and dealt with very leniently on all occasions; and his shortcomings had been mercifully overlooked. He was very much obliged to the members for all this; and without trespassing further on their time, he had to ask Mr. Ball to take the position to which he was elected three months ago.

The PRESIDENT-ELECT (Mr. T. B. Ball, of Rochdale) then took the chair vacated by Mr. Duxbury, and was received with applause on rising to propose the customary vote of thanks to his predecessor. He said Mr. Duxbury's attendance on the duties of the office had been most exemplary; and his conduct in the chair was at all times satisfactory. A gentleman who could always be approached, he was ready and willing to render the members any services they could reasonably expect of him. Their experience of him during the past year had been entirely satisfactory on all grounds; and he (the President) had much pleasure in asking them to accord him a very hearty vote of thanks.

Mr. HUNTER said he was very pleased to second the vote of thanks. No one could have devoted more time and attention to further the interests of the Institution than Mr, Duxbury had; and he deserved all credit for his efforts in that direction.

Mr. HUTCHINSON, in supporting the motion, said Mr. Duxbury had discharged the duties with a right hearty good will, which had commended itself very much to the members generally.

The resolution having been carried,

Mr. DUXBURY replied. He said he was obliged by the very kind remarks which had been made, and by the manner in which the members had received the vote of thanks. He had endeavoured to do his best while filling the chair. It was an honourable position, which he esteemed, though it carried with it obligations and responsibilities which anyone who was called to occupy it must feel. He was not elected on the grounds which Mr. Parkinson had named, because no grounds existed. Many eminent men had occupied the position before him; and he was afraid lest it should suffer in his hands. His object had been to render such service as he could to the gas industry, and to the members of the Institution in particular; and he hoped he had succeeded. At all events, he had endeavoured to avoid anything which would be to the disadvantage of the Institution, and had tried to help it on all he could.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which was published in the JOURNAL last week (pp. 432-4).

At the conclusion of the address,

Mr. NEWBIGGING proposed a vote of thanks to the President. The members would, he said, all peruse the address with very great pleasure, abounding as it did in pregnant and thoughtful remarks upon the industry in which they were all concerned.

Mr. VEEVERS seconded the resolution. By all rules of courtesy and usage, they were, he remarked, prohibited from criticizing the address, just as they were from criticizing deliverances from the pulpit of a church or chapel; but even if they were disposed to transgress the rule, they would find it difficult to select anything in the address with which to find fault.

Mr. DUXBURY cordially endorsed the remarks which had been made by the mover and seconder of the resolution. There were one or two points that he should like to have a word or two upon, if the address were discussable; and he sometimes thought it a pity they did not have some of the questions which were touched upon in such addresses brought up for discussion afterwards. He did not mean to suggest there would necessarily be any great conflict of opinion, but a discussion would bring out ideas and thoughts which might be very valuable.

The motion was agreed to.

The PRESIDENT, in acknowledging the vote, said no one was more conscious than himself of the many weak places in the address; and if he had had the time, he should have liked to strengthen them. But the past few months had been very busy ones; and he only devoted such time to the preparation of the address as was available after his other and more pressing duties were completed. He had regretted himself, on other occasions, that the President's address could not be discussed; but, having now come to that position, he found it a most salutary rule.

VOTES OF THANKS.

Mr. HUTCHINSON proposed a vote of thanks to the Secretary, the Treasurer, and Auditors. Referring especially to the Secretary, he said a great deal of labour had been placed upon Mr. Veevers, who had many other duties to discharge, but who had fulfilled this most admirably.

Mr. VARLEY seconded the resolution, which was adopted.

Mr. VEEVERS said that, in retiring from the position of Secretary, he should surrender his official connection with the Institution. He had been connected with it for 19 years; and he thought now that the burden of the work should fall on other shoulders. Any remarks which were therefore made as to the government of the Institution would have no future application to him.

Mr. CLARKE moved that the thanks of the meeting be accorded the Committee. Their office was not a sinecure; and if they attended to its duties, as he believed they had during the past year, they were deserving of thanks.

Mr. PARKINSON seconded the motion, which was heartily approved.

THE GAS INSTITUTE.

Mr. DUXBURY said the question had been asked by a few members of the Institution whether they had any information to give with respect to The Gas Institute. So far as their Institution was concerned, they did not exist to consider in any shape or form the affairs of The Gas Institute. They constituted there an association of their own, not affiliated at all with The Gas Institute; and except as individual members, they had nothing to do with it. But as a few of them happened to form a considerable majority of the remnant Council of The Gas Institute, they would be pleased to give their friends information respecting matters as they stood. He did not know that there were any secrets; but as an Institution, they did not propose to deal with the matter at all.

This concluded the business of the meeting; and the members afterwards had tea together.

OHIO GASLIGHT ASSOCIATION.—The annual meeting of this Association will be held at Mansfield on the 20th and 21st inst. The members are likely to have a busy time, seeing that no less than 46 subjects are announced for consideration. It is expected that 12 of these will be dealt with by papers; and the rest, if reached at all, will probably only be incidentally referred to. Electric lighting figures conspicuously among them; one subject being a proposition to change the name of the organization to the "Ohio Gas and Electric Association." The questions to be debated cannot be specially enumerated; suffice it to say that they embrace nearly every possible topic of interest to gas managers.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Twelfth Annual Meeting of this Association was held at the Grand Hotel, Birmingham, on Thursday, the 21st ult., as briefly reported in the following week's JOURNAL. The PRESIDENT (Mr. Charles Taylor, of Derby) occupied the chair; and there was a large attendance of members.

The HONORARY SECRETARY (Mr. J. S. Reeves, of Bilston) read the minutes of the preceding meeting; and they were confirmed.

COMMITTEE'S REPORT.

On the motion of Mr. J. WEST (Manchester), seconded by Mr. J. F. BELL (Stafford), the report of the Committee, which was given in the JOURNAL for the 26th ult., was adopted.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which appeared in the JOURNAL a fortnight ago, pp. 385-7.

At the close of the address,

Mr. C. HUNT (Birmingham) said he had listened with admiration to the address of the President, and could not but feel that the matters he had brought under the notice of the members were worthy of study. He moved that their best thanks be given to the President for his address.

Mr. R. O. PATERSON (Cheltenham) seconded the motion; remarking that the President had brought up before them matters which he hoped would be made the subject of papers during the coming year.

The motion was carried with applause.

The PRESIDENT said the short time at his disposal had prevented him making more extended remarks on the subjects he had referred to; and he could only thank those present very sincerely for their cordial vote to him.

DISTRICT ASSOCIATIONS REPORTS.

Mr. W. NORTH (Stourbridge) proposed that the reports of the District Associations be procured and distributed to the members, free of charge, in the current year.

Mr. W. WINSTANLEY (Newcastle) seconded the proposal.

Mr. J. F. BELL (Stafford) moved, as an amendment, that the reports be not supplied at the cost of the Association. There was a former proposal to engage a scientific lecturer; and this, he thought, would be better than expending money on the reports.

Mr. P. SIMPSON (Rugby), in seconding the amendment, observed that he hoped they were not going to give up the idea of the lectures. It was understood there would not be money to pay for the lectures and for the reports as well.

A short discussion followed, which was generally in favour of continuing the distribution of the reports to the members.

Mr. NORTH remarked that if the Association had the lectures, only part of the expense would fall upon the current year; and there would be funds sufficient for supplying the reports as well.

The amendment was put and lost; and the original motion was then carried.

The members next proceeded to discuss the paper read by the present President at the meeting in October last, entitled

AN OFT-REPEATED QUESTION: ARE HIGH CARBONIZING TEMPERATURES CONVENIENT AND PROFITABLE?

Mr. R. O. PATERSON (Cheltenham): I am sure that the members generally feel that the paper read by you, Mr. President, at our last meeting, deserves to be discussed, and discussed thoroughly. At the same time, the impression of your address to-day remains upon us; and perhaps we are not so ready to take up the discussion on a point on which all may not agree with you. One is not able to discuss the conclusions you have come to on your own ground, because there are assumed figures in it; and I do not think that is a conclusive way of putting the subject. If a practical gas manager is asked the question, Are high carbonizing temperatures convenient and profitable? I think there would be an unanimous expression of opinion that they are. After all, however, is it not more a question of comparative heats? What are high heats? I think there we all come to what may be called a dead stop; for I do not believe any one of us knows what a high heat is in reference to the carbonization of coal. I have made numerous experiments with coals of different qualities at various temperatures; and I have found this to be my experience: With some coals I cannot get too high a heat—that is to say, the higher the heat, the greater the quantity of gas, and the higher the illuminating power. While that is my experience with some kinds of coals, with others I find an opposite result; for I have carbonized them at a temperature which, as we express it in the laboratory, killed the coal. In other words, a large quantity of gas, but of low illuminating power was obtained. Therefore, to all intents and purposes, if we carbonize at too high a heat, we lessen the value of the product considerably. That we use high heats now, compared with what we employed some years ago, is perfectly evident; and the advances made in the production of gas, and the consequent reductions in price to the consumers, are largely due to the improvements in carbonization by obtaining a larger quantity of gas of a given quality from the coal. Whether we have proceeded as far in this direction as we can safely go, it is difficult to say. As far as my experience goes, with the coal I use, I appear at present to have reached the highest temperature at which I can profitably and advantageously work it in the retort-house. I am led to such a conclusion from this circumstance: During the early part of the winter, I had a very sudden and troublesome stoppage of naphthalene in the pipes between the lime purifiers and the oxide purifiers. These pipes and arrangements had been in existence for a considerable number of years; and I never yet knew naphthalene to be found in them. This winter I had stoppages on two occasions. At the time I was conscious of working at high temperatures—that is to say, higher than had been used previously. I reduced the temperature; and from that day to this, I have had no difficulty in this direction. The temperature, however, is still what some would call "high;" but not so high as I have seen at other gas-works. This brings one to a consideration of the conditions under which the heat is applied to the retorts. You may have an appearance of intense heat in the bench; but this does not necessarily mean that you are carbonizing coal at that high temperature. The power of the open fire in an ordinary setting of retorts may be comparatively small for the work required of it at certain periods—for instance, after clinkering and firing. At these times the heat of the setting is considerably reduced, and as, perhaps, just about this time, the retorts have been charged, the demands upon the fire are then in excess of its power; and although, after it has burned up the retorts, it may be at a high heat, still carbonization has been carried on at the most critical time at a low temperature. But in generator and regenerative furnaces, we have a constant and never-failing heat surrounding the retorts; and the heat of the bench never gets impaired. I shall be glad to hear the experience of others on this question of naphthalene in relation to high heats. High heats have generally been considered as tantamount to naphthalene troubles; and I found it so last winter. As I said, I removed my difficulty by lowering the heat of the retorts; but I am not at all sure—in fact, I think we shall find ultimately that there are other remedies which could have been applied to reduce this difficulty; and that I could thus secure the great advantage of a higher yield of gas from the coal.

Mr. J. TINDALL (Walsall): This is a very interesting subject, and one which refers to the most important branch of the manufacture of gas. It is really in the retort-house where we either make a profit or lose it. With regard to high heats, I find in my experience that, if they are too high, we impoverish the quality of the gas; and, by so doing, introduce into our process the primary cause of the formation of naphthalene. If, on the other hand, they are too low, we then become manufacturers of tar and liquor instead of gas—in fact, we turn the gas-works into a tar and liquor works, which many of them were before clay retorts were introduced. There is a suitable temperature at which to distil coals profitably, so as to obtain the best all-round results; and it is only from practical experience that one learns what this temperature should be. I have frequently to give instructions for the temperature of retorts to be raised as well as reduced. I think the paper and the remarks already made upon it point out the necessity of constant application of experience to circumstances as they arise, and to the coals we have in hand for distillation.

Mr. PATERSON, referring to his previous remarks about the difficulty that he had experienced on one occasion with naphthalene, said: There was no sudden lowering of temperature. The weather was quite normal, and there was no exposure of the pipes more than for years past; neither did I notice any appreciable alteration in the quality of the gas. I should like to have it understood that I must not be credited with a solution of the naphthalene difficulty. The experience I gave was practical experience which I think I was justified in laying before this meeting of practical gas managers. I am not at all sure now that the proper remedy was the lowering of the heats of the retorts. I have a shrewd suspicion the remedy lay somewhere else; but it was not in my hands at the time.

Mr. J. ANNAN (Wolverhampton): I think this is a matter which requires very careful consideration and discussion. I do not believe for a moment that coal distilled at an extraordinarily high heat can give the highest illuminating power; I have never found it so experimentally or practically. When I have worked the same coal experimentally at a high and low heat, I have always found a moderate heat gave me the best results. Take such a town as I have come from, where we have to supply a certain quality of gas. I find, when we have very high heats, the illuminating power goes down. In mixing the coals, it is possible to work higher heats, and get the same results; but with one kind of coal from North Wales, if I work with a very high heat, the illuminating power is not so good. If you take coal from Wrexham, and get the heats too high, a deficiency in illuminating power will be experienced. We must be guided very much in working the coal and heats, not to take too much from the coal; difficulties may arise either way. I do not believe in working too high or too low, but consider the medium to be the best as regards quantity and quality.

Mr. C. S. ELLERY (Bath): We are talking about high heats reducing the illuminating power of the gas. I am not sure that the exhauster is not very much more to blame than the high heats. If the heat does it, how does it do it? My own opinion is that the higher the heats, the better the results, other things being equal. As to the naphthalene in the pipes, I should like to know if the stoppage was sudden at the end? My impression is that these stoppages are not so sudden as they sometimes appear. The mischief is gradually taking place; and the effect is felt suddenly at the end. I have known a case where 60,000 or 70,000 cubic feet of gas passed hourly through a small hole in a 2-feet pipe. The accumulation had been going on, until a passage of about 2 inches diameter was left for the gas; and it amazed me that it was possible for so large a volume of gas to pass through so small a hole. When this 2-inch hole filled up, the stoppage was suddenly made apparent.

Mr. HENRY WOODALL (London): My experience agrees with that

of Mr. Paterson, as to certain coals producing their best results when carbonized at low heats; while others do better with high heats. In respect to inquiries of this character, those who are engaged in the management of large works are at a great disadvantage compared with those who have charge of smaller places. In the former, it is no uncommon thing for at least 20 different kinds of coal to be in use at the same time; while in the latter, it is often the case that one coal only will be used for years. Mr. Tindall has remarked that "profit is made or lost in the retort-house." I have always protested against this as the most fallacious and most harmful proposition that has ever been accepted by a gas manager. It has been fortified in its position by one of Mr. Newbigging's golden rules—"Keep up the heats in your retorts." Sometimes, and no doubt generally, it pays to keep up the heats; but at other times it does not. If a greater yield of gas is obtained, and the quality is to be maintained, it must be at the expense of the benzol in the tar. Yet I have known the time when, weight for weight, tar in the tank at the works was worth as much as gas in the holder. Tar at the time was worth but 3d. per gallon. But were the gas enriched out of the tar, it would not be by tar as such, at 3d. per gallon; but by the benzol out of it, which would be worth fully eight times as much. And, of course, the tar distiller would have to be reckoned with. We should be ready to take advantage of the markets, and raise or lower our heats in accordance therewith.

Mr. Charles Hunt (Birmingham): The subject is one I approach with diffidence, because, although perpetually engaging the attention of gas makers, it is at the same time one that almost from the nature of things is most obscure. I am of opinion that it is a subject of all others that would amply repay systematic research. It will not do to talk about getting 9000 or 10,000 cubic feet of gas per ton of coal, unless we know all about the coal, and particularly the temperature best suited for its distillation. I am inclined to believe with Mr. Tindall that every class, and indeed almost every variety of coal, requires a special temperature for the best results—in part proof of which I may refer to some experiments made under my direction a short time ago. A certain coal was distilled at different temperatures, varying from 1300° to 1500° Fahr. It is not very easy to get at the exact temperature of a retort; but the test I applied was that of raising the temperature of a given volume of water by means of a copper cube previously heated inside the retort. This I found to be fairly reliable. The best results, as regards yield of gas and illuminating power, were obtained, not with a temperature corresponding with what are called "high heats," but with a medium temperature of about 1450°. Another coal gave the best results with a recorded temperature of 1300°. There can be no question as to the influence of the exhauster in these experiments, since no exhauster was employed; the trials having been made at the experimental works, with a ½ cwt. charge. They cannot, of course, be regarded as conclusive on the point; but I feel that, coupled with the evidence afforded on a working scale, they tend to shake one's belief in the desirability of "high heats." With regard also to the question of naphthalene and stopped pipes, I am coming round to the belief that these resolve themselves very much into one of the temperature of distillation. We have been too much in the habit of disregarding surrounding circumstances; of fixing the eye upon getting larger and larger makes per mouthpiece irrespective of, or apart from, the size of the retort or description of coal. It has not always been considered that the larger the retort and the heavier the charge, the longer does it take to work off. We have been gradually collecting facts that go a long way to support the opinions I have expressed—viz., that naphthalene and stopped pipes are largely—though not perhaps solely—the effect of high temperatures. It was once said of Birmingham that freedom of naphthalene was secured by reason of the particular kind of coal in use; but with the same kind of coal Birmingham has at times been as much plagued with naphthalene as any other place. To what is this attributable? What change has taken place? Undoubtedly, at the time to which I refer the retorts were being worked at a high temperature; and when this was moderated the evil disappeared. Practically, though not in so marked a degree, the same observation applies to stopped pipes. For these, it will be safe to say, there is no universal cure; but it will be equally safe to say that they do not occur where low or moderate heats are employed. This observation leads me to say this, with regard to regenerative furnaces—that the great facility afforded by them for raising the heat of the retort, is an important cause working in the direction both of stopped pipes and naphthalene. Under the old system of firing, it was not possible to force the heat if small or dusty coal was used. We had to take our chance of getting as much as we could out of such material; whereas with a regenerative furnace, any amount of heat is available for burning off the charge in the given time, whether a large or a small one, whether the coal be lumpy or consist merely of slack. Small coal, lying denser in the retort than large, requires a greater amount of heat to become carbonized in a given time, and hence stopped pipes are more frequent when this is employed. This at any rate may be one of the reasons, although not perhaps the sole reason. With regard to the manner in which the illuminating power is influenced by temperature, and the remarks made thereon by Mr. Woodall, I may say I have been told that, where very high heats are employed, while the benzole in the resultant tar is generally deficient in quantity, it is at the same time superior in quality to that which is derived from tar produced under a lower temperature of distillation. On the other hand, it has more than once been quoted as an evidence of good carbonizing, that the tar produced has a bad name with the distiller. I am not quite sure that the boast is justifiable. At all events my experience seems to show that the very best carbonizing results, as regards yield of gas and illuminating power, are obtained concurrently with the greatest yield of tar and ammoniacal liquor—that is to say, if we force the heats with the sole object of getting gas, we run the risk of losing instead of gaining, not only in production of gas, but in that of tar also; whereas with a heat suited to the material, we not only get full value in gas, but in other residuals also. I am also of opinion that this is the object to strive for; and to this end we should aim at finding out what really is the proper temperature for distilling the material we have to deal with.

Mr. J. F. Bell (Stafford): I agree with Mr. Hunt that there is a temperature at which you can get a maximum yield of gas and ammoniacal liquor, with a fair quantity of tar. I find the centre retorts are those which trouble us with stopped pipes; but, by lowering the heats, with short charges, we get rid of this difficulty to some extent. One gentleman wanted to know whether the increase of temperature depreciates the quality of the gas. In my opinion it does if you get beyond a certain temperature, because the hydrocarbons are split up; and it is these very hot centre retorts, which I think break up the hydrocarbons that trouble us with stopped pipes, besides getting quickly carboned up. I did not intend to enter into this discussion, but may perhaps corroborate Mr. Paterson's remark that, in comparing ordinary retort-settings with those heated by means of regenerative or generator furnaces, you may easily be misled as to the relative temperatures. I arrange for charges every half hour and hour throughout the 24 hours; but between six and eight o'clock in the morning, and at night (this being the time the furnaces are cleared), when we are using retorts heated by ordinary settings, we always make less gas during these two hours than in the others. When using the regenerative furnace, I find very little difference.

Mr. B. W. Smith (Smethwick): As regards the remarks of the last speaker respecting hydrocarbons, I was troubled for some considerable time with stopped pipes; and I found that, notwithstanding that I increased the area of the ascension and dip pipes, I still had the same trouble. The conclusion I have come to is, that the higher temperature at which we are now working, as compared with what we used to do, causes the tarry matter to split up, and a portion is formed into a gaseous body—that is, the light oils, which would otherwise pass at a lower temperature with the tar, are carried along with the gas, and what really remains of the tar passes along in a pitchy nature. Hence the difficulty spoken of. In respect to the distillation of coals at various temperatures, I quite agree with other speakers, that each coal requires its own temperature; the denser the coal, the higher the temperature needed. We have our coal from various districts; and I have found that what suited one coal would not do for another, and that especially as regards the Welsh coal, this requires a higher temperature than the Derbyshire. I can see it would be difficult in large works to control the temperature for separate coal; and it is only by mixing various kinds that you can strike the mean. Until we find, and can work at the correct temperature for each coal, we shall never be free from stopped pipes, although I agree that stoppage is also due in a great measure to the seal. I quite concur with Mr. Hunt, that it is very necessary that a proper Research Committee should be appointed to inquire into this matter. It is one which ought to be taken up soon. I think our late President referred to it in his address.

Mr. J. West (Manchester): The more we discuss this subject, the more complex it appears. We have gone on increasing our heats during the last ten years; and the question is what we should term high heats, and where we shall stop? Mr. Paterson says he does not know where we ought to stop. It depends to a certain extent upon the material we are using. I think the general opinion is that high heats, where we can avoid stopped pipes and other difficulties, are advantageous. The President, in his tabulated comparisons in the paper, gives the wages and salaries as the same for carbonizing with low temperatures as with the high ones with the higher yield; but he hardly gives the high heats due credit. He only pays the same for labour for putting the coal into the retorts; but he would get another 1000 cubic feet of gas. There would also be a great saving in plant, as less is required where high heats are used. Then, the President puts a larger amount for wear and tear with high heats. Now, I very much question that item. There would be a greater annual expense; but what would be the wear and tear per 1000 cubic feet of gas? My experience is that it would be less, and that the life of the retort would be longer—that is, it would turn out a large volume of gas with a higher than a lower heat. The practical difficulties we have to contend with are very great. When I was at Manchester, we had some 25 different kinds of cannel and coal in use; and though I do not think it advisable to have so many sorts, there was the fact that we had to contend with it, and could not do either kind full justice. Where gas managers have the same kind of material to deal with, I think they might easily work out the most advantageous heat which should be applied for any particular coal. There is no doubt that you get more units of light out of the higher than the lower and moderate heats; but my opinion is that you should work with moderately high heats till you get the result you want, and there stop. Assuming you work with high heats, and must supply gas of a certain

illuminating power to the public, you must stop at that point, and not go on making a larger volume of gas than will produce the desired result. There was one important question raised as to naphthalene. We all seem to have had strange experiences in that particular. When I was in the South, I was troubled for years with naphthalene; but I built new works just the other side of the old ones, and after the new works were erected, although I considerably increased the make of gas per ton of coal, naphthalene disappeared. This is contrary to opinions we have heard expressed. I was using the same kind of coal—Newcastle. After the new works were erected, we had to remove a pipe leading to the gas-holder. I found that this pipe had been passing through a sewer into which steam was discharged. The pipe got heated, and so heated the gas before it passed into the holder; and it had to be cleared out very frequently. After the steam-pipe was taken out, we never had any naphthalene. You know I began to increase the heat of retorts years ago; and I believe it is the proper thing to do. As to the point Mr. Hunt mentioned about benzole, in a certain carbonizing works I knew they struggled to get the highest heats they could for the production of benzole; and they told me they obtained more and better benzole by the higher heats than the moderate ones.

Mr. PATERSON: That was using South Yorkshire coal. I think that ought to be stated, because it alters the facts.

Mr. WEST: There was another point Mr. Hunt touched upon, which I do not agree with, because I have proved it over and over again to the contrary. That is, as to the question of small coal or broken coals being conducive of stopped pipes: I have worked it all ways; and it has been tried on a large scale at some extensive works. It has not been proved that broken coal has anything to do with stopped pipes. I do not see why it should, because you cannot carry coal up the ascension pipe. I think the exhauster has more to do with stopped pipes than anything else. My advice would be not to have any exhaust, but to have the slightest pressure possible in the retorts.

Mr. HUNT: What I meant by small coal was what would be called screened coal—unscreened coal, with the lumps taken out.

Mr. PATERSON: I ask for permission to make a small explanation. When I said I reduced the heat of the retorts for the purpose of removing the naphthalene difficulty I was experiencing, I ought to have mentioned that I did not reduce the amount of fuel I was burning in the furnace of those benches; and therefore I cannot be said to have reduced the heat of the bench. I found the centre of my retorts too hot; and while I reduced the heat on the centre of the bench, there was the same amount of fuel used, only it was differently distributed.

Mr. WEST: Did you reduce the make?

Mr. PATERSON: Yes; it sensibly reduced the make per ton.

The PRESIDENT: I am gratified to have had so satisfactory a discussion on the subject before us; and the remarks of the several speakers make it unnecessary I should say much in reply. Mr. Paterson remarked that my paper was based upon assumptions, and that to produce the most profitable results each kind of coal must be carbonized under the temperature found by experience and experiment to be most suitable. My paper certainly contained assumptions; but the actual data used for my guidance are indicated. The paper was written to provoke discussion upon the question of how far it is advisable to raise the heat of retorts for the purpose of increasing yield, and to bring out what has been brought out. That each kind of coal has a specific temperature of carbonization is, of course, accepted. I understood one speaker to say the illuminating power will decrease in the ratio of increase of yield; but it has been shown that, at the higher yields, illuminating power is not affected by considerable variations of temperature. Mr. West points out that the wages put down for carbonizing are the same in one case as in the other. I apprehend this should be so; seeing that the same weight is carbonized in each case. It is in the employment of the higher divisor that the gain in cost becomes apparent—the larger yield diminishing the cost per 1000 cubic feet. Another speaker asks how it happened that the cost of fuel was more in one case than in the other? That is an assumption. I assume, for the purpose of the paper, that there may be a *pro rata* increase in the quantity of fuel for the increased yield. If looked into, it will, I think, be found that the figures are placed as they should be.

A vote of thanks was then passed to the President for his conduct in the chair; and the members subsequently dined together.

THE LONDON COAL AND WINE DUES.—Notices have been given by Sir J. Pease to oppose the Bill introduced by Sir R. Fowler to continue the above dues; and by the latter gentleman to oppose Sir Joseph's measure to abolish them.

THE INSTITUTE OF CHEMISTRY.—The anniversary meeting of this Institute was held last Friday week at Burlington House, W., when the officers for the ensuing year were appointed, and Dr. James Bell, F.R.S., was re-elected President. Dr. Bell, in his address, stated that during the past year there had been an increase of 38 Associates and 141 Fellows; and the income had exceeded the expenditure by £737. At the first annual meeting in 1878, the number of Fellows on the register was 225; now it is 768. Dr. Bell indicated several directions in which the efficiency of the Institute has been much increased; and among other improvements suggested was an annual meeting of the Fellows, to last two or three days, at which papers might be read and discussions held on subjects in practical chemistry.

ON THE CONSTRUCTION OF GASHOLDER TANKS.

By CHARLES HUNT, M. Inst. C.E., of Birmingham.

[A Paper read before the Association of Birmingham Students of the Institution of Civil Engineers, Wednesday, Feb. 20, 1889.]

(*Concluded from p.* 436.)

When puddle is to be used for making the tank water-tight, this is prepared from good stiff clay by well soaking it with water, cutting it up, and turning it over until it becomes a soft homogeneous mass. It is then thrown into the trench from the top, so as to unite it as firmly as possible; the bottom being covered to a depth varying according to circumstances from 1 ft. 6 in. to 2 ft. 6 in. On the top of this thickness should be laid 1½ inch elm boards, the object of which is to spread the weight of the wall, and so prevent the uneven settlement which might otherwise occur from the yielding nature of the puddle. The wall should be set out with a liberal width of footings. As it is carried up, it has to take the weight of the earth inside the tank until the excavation can be completed. Great care has to be exercised in filling in at the back, so as to leave the backing as solid as possible after the runners are withdrawn. At the lower portion, the filling in will be mostly puddle; but as the trench widens towards the top, and the wall becomes less in thickness, it is necessary to back up the puddle with carefully selected earth, well punned and watered. When dealing with exceptionally unfavourable soil, it is often advisable to leave in the bottom runners, so as to avoid the risk of further disturbance of it. In the Windsor Street tanks, not only had a great quantity of the timber to be left in, but the space between it and the back of the wall for a height of 23 feet from the bottom, was filled in solid with lime concrete. The puddle having a thickness of (say) 2 feet at the bottom, reduced a little towards the top, should be built up in layers of from 1 foot to 2 feet in depth, following the growth of the wall; the face of each layer being carefully cleaned of all dirt, and well cut up and watered before the next layer is thrown down upon it. To ensure the correct dimensions being obtained, a trammel is used, the length of which corresponds to the radius of the tank. This is constructed as rigidly as possible, and usually of timber. It is secured upon a pivot placed exactly in the centre of the tank, having additional points of support where these are necessary from its length. It should be worked round the entire circumference of the tank at frequent intervals while the wall is being brought up; a plumb-line suspended from its extremity enabling the accuracy of the work to be checked, or any bulging to be detected. In addition to this, the face of the wall should be set to templates cut to the exact sweep of the circle to be described.

As soon as the wall is completed, excavation of the interior may be commenced. For small tanks, it is very usual to take out the whole of this, and form the bottom perfectly flat, covering the puddle with a substantial brick or concrete floor. In large structures, however, the cost of this excavation is an item not to be disregarded; and therefore it is the practice to leave in as much as possible of the soil, having regard to its angle of repose. The diagrams (figs. 5 and 6*) show some of the most important examples both of puddled and rendered gasholder tanks; and from these will be seen the extent to which the excavation of the interior may be avoided, according to the favorableness or otherwise of the soil. In Mr. Livesey's tank (fig. 6), the soil proved to be conformable in a very high degree, and advantage was taken of this to the utmost; whereas in the Windsor Street tanks, one of which is shown on the same diagram, it was impossible to form the cone with any greater incline than is seen upon the drawing. The attempt was made, but had to be abandoned because the soil began to slide in several places. These examples relate to loose, or partly loose subsoils, such as have more frequently to be dealt with; but where the tank can be placed in rock, like the one at Liverpool, all excavation of the interior is dispensed with. By leaving the cone as large as the circumstances will admit of, and so reducing the depth of the tank over a not-inconsiderable area, there is, in addition to the saving in cost, the further advantage of proportionately diminishing the pressure upon the bottom, and consequently the liability to leakage.

The puddle requires to be continued from underneath the footings of the wall, without break of any kind, over the whole area of the tank. The ground upon which it is to be laid must be quite solid, and not liable to be disturbed by the pumping operations. Where much of the soil is drawn away with the water, and the puddle is undermined to any extent, there is every probability of leakage after the tank is filled. I once had to do with a tank which gave a great deal of trouble in this way. It had been built partly in running sand, but was fairly water-tight until, owing to a very serious accident, the gasholder had to be renewed. It then became necessary to empty the tank, and keep it clear of water for a long period. Advantage was taken of this to renew the puddle in many places; but as soon as the tank was re-filled it began to leak seriously. A diver was employed to examine the bottom, when it was found that, close to the wall, the puddle had

* Fig. 5 showed (at top) a section of the brick tank, 200 feet diameter, at the Windsor Street Gas-Works, Birmingham, as given in the JOURNAL at the time of its completion, and subsequently reprinted in "King's Treatise on Coal Gas," Vol. II., pp. 67 *et seq.*; and (at bottom) the brick tank constructed for the Phœnix Gas Company, at Kennington, and similarly illustrated and described—see "Treatise," Vol. II., pp. 76 *et seq.* Fig. 6 showed (at top) the 218 feet diameter concrete tank at the Old Kent Road works of the South Metropolitan Gas Company—see JOURNAL, Vol. XXXVI., p. 644; and (at foot) the Windsor Street, Birmingham, 240-feet tank, as described in the JOURNAL, Vol. XLVII., p. 111.

given way in several places, owing to the withdrawal of the soil from beneath it. At first it had, no doubt, opened slightly—perhaps just sufficiently to let the water through; and this had soon worn a wider passage. This examination had to be repeated several times; and the holes, as discovered, were stopped with clay bags—*i.e.*, small canvas bags filled with clay puddle.

For rendered tanks, a perfectly solid bottom is of equal importance. Much difficulty in this respect was experienced with the two tanks at Windsor Street. This did not arise from the action of the pumps, the water from which, at this stage of the operations, was uniformly clear, the suction resting partly upon the sandstone. The ground, however, was full of water, which obstinately refused to pass to the much lower level of the sumps; preferring, instead, the opposite direction. It therefore had to be led away by means of a drain formed of earthenware pipes carried round each tank beneath the concrete floor, a few feet from the base of the wall. These drains became periodically choked with soil, and had to be cleared out at the openings, which were left at intervals both for this purpose and also to afford a vent in case of anything happening, such as a breakdown of the pumps, by which the water might temporarily return to its natural level. This, by the way, is a contingency which has always to be guarded against, not only during the construction of the tank, but also while the holder is being put in. If no vents were left, the pressure of the water when rising might seriously injure the puddle or concrete bottom. When these tanks were finished, and the water had been filled in, considerable leakage was apparent. This, on examination, was found to proceed from cracks in the cement rendering, caused by a settlement of portions of the floor; and was reduced to a very small amount by caulking the cracks with hemp and tallow.

As already mentioned, diagrams Nos. 5 and 6 illustrate some of the most prominent examples of puddled and rendered tanks. Of the former class the upper figure shows one of the tanks at Windsor Street, to which reference has been made; while the lower figure shows one partly in the solid clay—the basin being completed by a continuation of clay puddle up through the sand, and ballast to the ground level. Both are of brick, although concrete was employed—in the one, for covering the puddle, as a protection against injury; and in the other, for building the piers upon which rests the timber framing, provided, in each of the tanks under review, for the purpose of supporting the crown of the gasholder while this is out of action.

The fine tank at the Old Kent Road works of the South Metropolitan Gas Company is seen in the upper figure (diagram 6). This is constructed wholly of Portland cement concrete, composed of gravel obtained from the excavation, with a mixture of broken retorts and furnace clinkers. It rests upon a chalk foundation, and is carried up through a substratum of sand and gravel. It will be observed that the wall, instead of being thickest at the bottom, and tapering from bottom to top, gradually widens from the bottom and is thickest at a height of about 20 feet, from which point it tapers to the top. This widening out was caused by the trench being filled in completely with concrete, so as not to leave any loose earth behind it—a precaution suggested by experience with a tank, similarly constructed of concrete, which, on being filled with water, cracked from top to bottom. In addition, wrought-iron bands, completely encircling the tank, were embedded at intervals in the concrete wall. Such bands are of considerable service for strengthening a rendered wall, more especially the upper portion, where the backing is necessarily weakest. At one time they were frequently used for brick and puddle tanks; but their utility in this connection is less apparent. Nor can they be of much service when the rendered wall is of brick, because either the bond of the brickwork must be seriously broken by building them inside the wall, or, if carried outside, it must be difficult to tighten up so large a circle so as to secure even tension, without which the bands could not be of much use. This, at all events, is the view that influenced me in deciding against their employment for the Windsor Street tanks, and from which I have since seen no reason for departing.

Where cement rendering is used, it is generally applied in two coats—the first, from $\frac{3}{8}$ to $\frac{1}{2}$ inch thick, consisting of Portland cement and washed sand in equal parts; and the finishing coat, about $\frac{1}{4}$ inch thick, of neat cement. In France it is customary to employ a much greater thickness; a maximum of $3\frac{1}{8}$ inches being mentioned by an authoritative writer on the subject, composed wholly of cement and sand in equal proportions—no neat cement being used.

As the pressure of the water within a rendered tank is exerted upon the face of the wall, it may be useful to note the strain to which the latter is thus subjected, and which has to be provided for, either by strengthening the wall itself, or by ensuring the solidity of the backing. Suppose a gasholder tank to be 40 feet in depth and 200 feet in diameter, situated in loose earth, the natural level of the water would be 20 feet below the surface of the ground, or one-half the depth of the tank. It should be mentioned here that it is not by any means an uncommon practice to raise the coping level of a tank a few feet above the surface of the ground, protecting this upper portion with a firm and tolerably wide embankment. This, however, would not at all affect the present calculation, for which purpose the coping level of the tank corresponds to the surface level. Mr. B. Baker, M. Inst. C.E., is my authority for stating that the lateral pressure of dry backing, such as may here be assumed, is about half of an equal column of water, while the lateral pressure of water-logged backing may be taken as $1\frac{1}{2}$ times that of water. Therefore in this example the lateral pressure of the ground at the bottom of the tank will be exactly equal to that of the column of water inside the tank. Thus:

$$20 \times \tfrac{1}{2} = 10$$
$$20 \times 1\tfrac{1}{2} = 30$$

Equivalent column of water = 40 feet.

So that, when the tank is filled to the full height, the water will just balance the outside pressure of ground at the base of the tank. It follows also that the bursting pressure will be a maximum at the point where the dry backing joins the water-logged backing, which is at half the height. At this level the bursting pressure will be 20 ft. $\times \frac{62{\cdot}5}{2}$ lbs. per cubic foot = 625 lbs. per square foot; and, as the radius of the tank equals 100 feet, the tension on the brickwork of the tank for 1 foot in height at this level will be 100 ft. $\times$ 625 lbs. = 62,500 lbs. Suppose the thickness of the walls to be 36 inches, the area will be $36 \times 12 = 432$; and therefore the strain per square inch will be 62,500 lbs. $\div$ 432 = 144·68 lbs. at a point half way up the tank. Similarly the strains above and below this point can be calculated. It must be remembered, however, that there is always a disturbing element to all calculations of this kind, in the compressibility of all backing, however carefully it may be formed. The very best backing is made of sand, well watered and punned in thin layers. There is also the possibility of the water being drawn from around the tank by operations in the neighbourhood, which makes it desirable, that the tank should possess sufficient strength to stand by itself with the help of the backing alone, if ever that event should occur.

Other varieties of tank building may be very briefly alluded to. For example, tanks built of stone bedded and set in cement have proved, after being filled for a short time, perfectly water-tight. In Italy, puzzolana is much used as a substitute for cement. Then there is the method shown by diagram No. 3, which is the Liverpool tank already referred to. Here the impervious material is sandwiched between two 9-inch thicknesses of brickwork. In this case, the material employed was asphalte—almost the only application of it for tank building. In his description of this tank, the Engineer states that previous tanks had been constructed in a similar manner, but with cement in place of the asphalte. There does not appear to be any particular advantage in thus protecting the cement; all that is required being to face the sandstone, and then render this face in the usual way.

Reverting to the question of cost, it may be stated that opinions have differed as to the advantage to be derived from the substitution of rendered concrete wall for brick and puddle; as much as one-third being claimed as the amount of economy effected. This would appear to be borne out by one or two examples of cost that have been published. Thus, at Portsea a brick tank 158 feet in diameter is stated to have cost £28 per 1000 cubic feet capacity; while a concrete tank, 165 feet in diameter, subsequently constructed, cost only £18. Again, the brick tanks at the South Metropolitan Gas-Works, cost from £25 to £27 per 1000 cubic feet capacity; wherens a concrete tank built in 1872 cost only £18 12s., or about two-thirds. As, however, another concrete tank constructed a few years later, cost only £9 16s., it is but fair to infer that other circumstances than the actual difference in cost of material have operated in these cases. The saving to be effected by the use of concrete combined with cement rendering must always be very much a question of locality; but under ordinary conditions it may be stated at from 12 to 15 per cent.

The following table, giving particulars of the cost of tanks of various kinds, may fittingly conclude this paper:—

Description and Locality of Tank.	Diameter.	Depth.	Cost of Tank.	Cost per 1000 Cubic Feet Capacity.
	Ft. In.	Ft. In.	£	£
Brick and puddle tanks—				
Birmingham	82 0	20 9	1,902	17·3
Do.	97 0	20 9	2,250	14·7
Do.	102 0	24 9	3,882	19·2
Do.	102 0	24 9	3,420	16·9
Do.	142 0	24 9	5,850	15·3
Do.	185 0	41 0	18,190	16·5
*Do.	200 0	37 0	16,800*	14·4*
*Do.	200 0	37 0	20,800*	17·8*
Salford†	154 0	40 0	11,700	15·7
Fulham	233 0	32 0	10,000	7·3
Kennington Lane	218 0	44 6	21,446	12·9
Beckton	195 0	37 6	15,000	13·4
Leicester	172 0	37 0	15,200	16·5
Brick tank, Bolton‡	142 6	32 0	7,066	14·0
Concrete and puddle tank, Nine Elms, London	200 0	45 0	17,600	12·4
Concrete and rendered tank, Old Kent Road, London.	218 0	55 6	20,300§	9·8

* Inclusive in each case of £1200 for timber framing to the gasholder crown.
† Puddle found on site. No pumping.
‡ No puddle; a cavity between two walls filled with hydraulic mortar.
§ Inclusive of £1800 for timber framing, valves, &c.

Mr. R. H. Townsley has been appointed Manager of the York Street Gas-Works of the Leeds Corporation.

At the half-yearly meeting of the Metropolitan Gas Company of Melbourne, held on the 28th of January last, a dividend at the rate of 18 per cent. per annumwas declared. A sum of £20,000 was added to the reserve fund; and £27,608 was carried forward

GAS MOTORS AND THEIR IMPORTANCE FOR SMALL INDUSTRIES.

[Translated from the *Journal de l'Eclairage au Gaz* by the *Chemical Trade Journal*.]

The economic situation scarcely affords room for romantic ideas. It is absolutely necessary for the economical system of a country that it follows up with great perspicuity every proved advance in industrial development, and opposes every individual attempt made to hinder it. From the abstract point of view of humanity, it is but little assuring to see small industries disappearing, absorbed by larger concerns. It is not a question, however, of making huge efforts to obviate this state of affairs; on the contrary, it will be sufficient to modify the conditions under which motive power is available, and to render it more accessible.

The most certain means of attaining this end is the introduction of gas motors into small industries. We were, therefore, much interested in the issue of a circular, two years ago, by the Government of Dusseldorf, recommending all consulting engineers in its district to advocate the employment of gas motors. Many districts had already, in the summer of 1888, responded to this circular; and the following table gives some interesting information upon this subject:—

TABLE I.

Name of District.	Ordinary Price per Cub. Mètre of Gas.	Reduced price for large customers.	Price of gas used for motors.	Gas-Engines. Number.	Gas-Engines. Horse-Power.
	Centms.	Centimes.	Centimes.		
Barme	21·87	21·25 to 13·75	10	46	82
Clèves	22·50	Up to 20·0	18	46	82
Crefeld	24·25	15·00	12	36	89
Dillken	25·00	16·25	20 to 10	36	89
Dusseldorf	22·50	15·75	12	33	91
Duisbourg	18·73	13·75	12 to 8	9	45
Elberfeld	20·00	18·75	16	50	91
Emmerich	22·00	18·75	18	4	91
Essen	18·75	16·25	15	6	15
Geldern	26·25	16·25	17	2	5
Gladbach-Rheydt.	20·00	Up to 16·16	12 to 9	21	36
Odenkirchen					
Grevenbroich	27·50	,,	12 to 6	4	21½
Hilden	18·10	,,	14·5	4	21½
Hückeswagen	31·25	,,	25	4	21½
Kempen	21·25	,,	17	5	5
Lengenberg	40·00	,,	32	5	5
Lennep	22·50	,,	18	3	8
Mittmann	22·50	Up to 15	18	4	8
Mulheim-sur-Ruhr	18·75	,,	13	6	5
Neuss	20·00	,,	16	6	5
Neviges	31·25	Up to 25 ,,	25	6	5
Oberhausen	20·00	,, 15 ,,	16	4	30
Remscheid	21·25	10 p.c. dis. for 100,000 c.m. up to 17·5	12	21	53
Rowsdorf	18·75	,,	12	16	31
Ruhrort	22·50	Up to 18·0	12 to 10	6	36½
Solingen	25·00	,,	16	4	9
Steele	18·75	,,	15	1	2
Uerdingen	28·75	,,	22	1	1
Viersen Süchteln	22·50	,,	13·5	19	1
Wald	25·00	,,	20	19	1
Werden	18·75	,,	15	19	1
Wermelskirchen	15·00	,,	8	4	10
Wesel	16·87	,,	13·5	22	44

In the strife of small industries against large, the gas motor is the best aid which can be afforded to the former. Thanks to this engine, small industries are put in a position to produce as economically as large ones, or, since the general expenses are rarely high, even more economically. The results obtained naturally depend to a great extent on the type of motor chosen, which should satisfy the following conditions:—(1) It must be ready to be set in motion at any moment without any preparation. (2) Any mechanic should be able to execute all necessary repairs; cleaning should be of such a nature as to be readily accomplished by the owner. (3) During work it should not be liable to any stoppage. (4) It should occupy as little space as possible. (5) The cost of working should be small. (6) Initial cost should also not be high. If these fundamental conditions be well fulfilled—and this is easily done in practice—a comparison between the suitability of gas motors and steam or compressed air motors for small industries results, except in a few special cases, in favour of the former. Many improvements have been introduced in the construction of these engines at the Deutz works, and by the Messrs. Körting, of Hanover; and since the price of gas used for obtaining power has been lowered, this class of motors has come largely into favour.

It is impossible to draw an accurate comparison between the amount of power actually yielded by steam and gas engines. So many details affect the experience of these two methods of production that general remarks alone are possible. The expense of fuel per horse power in large engines supplied from excellent boilers stands to that incurred in the working of small engines as 1:5. The difference in the consumption of gas in motors of different dimensions never varies more than as 1:2. The wages of the workmen, cost of maintenance, and, finally, the cost of gas must all be taken into account. It may be admitted that in general where much power is continuously used, a better result can be obtained by employing a steam-engine with good boilers than a gas-engine. There is, however, no doubt but that even in this case the use of a gas-engine will prove more economical if the price of fuel be high. It must not be forgotten, in considering the question from this point of view, that with gas no attention is required, that repairs are few, and that the expense always varies with the work performed. It must also be borne in mind, however, that the price of gas always depends on that of fuel. It would, therefore, be necessary to have command of a supply of natural gas, or of a poor fuel which could be converted into water gas or Siemens gas to realize the results described above.

According to the statement put forward by the Directors of the Company at Remscheid, the advantages of gas-engines are as follows:—(1) Gas-engines do not require boilers; and hence carriage of fuel or cinders. Attention, cleaning, and repairing of boilers are all done away with. As soon as the gas has been lighted, the gas-engine is in a position to do its maximum of work; and it is just as easy to stop it. During its operation, no attention is required; and there is no noise. Finally, it can be placed at any elevation. (2) The gas motor is free from all danger of fire or explosion; no special authorization from the police is required; no specification of its situation; and even the rate of insurance against fire is not increased. (3) As a result of the reduction in the price of the gas employed for engines, the price of power has in general become very favourable, especially in places where frequent stoppages are necessary, no gas being consumed when stopping.

Other considerations may be added to these—(1) Absence of installation work. (2) Freedom from all expenses connected with putting in boilers and flues. (3) Saving effected in insurance rates, and in testing and maintenance of boilers. (4) The consumption of gas is proportional to the power employed. It varies from 600 to 800 litres per horse power per hour, according to the size of the engine. If less work is done, the supply of gas is automatically regulated.

The working of a 2-horse power gas-engine for ten hours costs—

	Frs.
16 cubic metres of gas at 0·125 fr.	2·00
Oil, lubricants, &c.	0·50
Total	2·50

The small manufacturer endeavours to utilize his engine to the utmost extent, since it does not occupy much room, and does not increase his rent. The largest consumption of gas takes place among the typographers; and then in mechanics' and tinworkers' shops. Weighing and chopping machines have also been erected (since the fall in the price of gas) in slaughtering-houses. Gas-engines are also employed to drive dynamos for electric lighting. Many gas-works supply motors to small manufacturers, &c., on account; the amount due being payable by instalments. Considerable success has attended this movement, the conditions being as follows:—(1) After the installation of the motor, 20 per cent. of the total cost. (2) Every three months a payment of interest on the basis of 4½ per cent. per annum. (3) At the commencement of each month an instalment of such amount that in five years the machine becomes the property of the borrower. (4) Expenses of installation and repairs must be settled at once. Under these conditions, the purchaser has every interest in taking proper care of the machine. It has also been proposed that gas companies should buy motors, and rent them to their customers.

We owe to the kindness of the Director of the gas-works at Remscheid an interesting curve, giving the consumption of gas for a year in this district, both for lighting and motive purposes. The curve shows how the regularity of the consumption in the case of gas-engines has enabled the Company to lower the price of gas; and how this concession has largely aided in bringing about the increased use of gas-engines. The chief numbers quoted are given in the following table:—

TABLE II.

The Consumption of Gas at Remscheid.

Date.	No. of Gas-Engines.	Total Power.	Price of Gas.	Consumption of Gas.	Total Consumption
1880–1	10	22	21·25c. per cubic metre, with 10 p.c. off for first 2000 cubic metres, 15 p.c. for second, and 20 p.c. for third 2000	15·100	2·775
1881–2	12	35	,, ,,	15·300	2·812
1882–3	18	30	,, ,,	18·300	3·450
1883–4	15	32	,, ,,	19·000	3·487
1884–5	15	32	,, ,,	20·000	3·620
1885–6	16	32	From Oct. 1, 1885, gas was reduced to 0·15 fr. per cubic metre	21·653	3·247
1886–7	23	57	15 c. per cubic mètre	57·086	8·562
1887–8	34	86	13·7 c. ,,	94·971	13·057
1888–9	40	96	11·25 c. ,, (Suppression of meter-rent)	145·000	16·112

It will be at once seen how the consumption of gas for motive power has regularly increased from 1880 to 1888, and also how this increase has assumed far greater dimensions since the fall of price in 1886. Since this time, when the price was reduced to 11·25c. per cubic metre, and the suppression of the rent for meters, there is scarcely a small manufacturer who does not employ a gas-engine.

THE USE OF OXYGEN IN GAS PURIFICATION.

In the course of a paper on "Some Industrial Applications of Oxygen," recently read before the London Section of the Society of Chemical Industry by Dr. L. T. Thorne, the author made special reference to the use of oxygen in the purification of gas, and to the experiments carried out by Mr. W. A. Valon at the Westgate-on-Sea Gas-Works, as described by him in the paper he read at the meeting of The Gas Institute in June last, and given in the JOURNAL for the 26th of that month (p. 1174).

Dr. Thorne commenced by giving credit to Brin's Oxygen Company for the solution of the long-mooted problem of the preparation of oxygen on a large scale at a price which would bring it within the range of industrial applications. Before entering on the consideration of these applications, he briefly alluded to the present position of oxygen production; for though, he said, Boussingault's classical researches point undoubtedly to the atmosphere as the source for oxygen, and to barium oxide as the medium for its extraction, the practical difficulties of the process—one of the chief amongst which was the gradual diminution of the absorptive power of the oxide for oxygen—have hitherto prevented its being practically carried out. Now, however, these difficulties have been so far overcome that, including all costs, the production of oxygen will certainly not exceed 7s. 6d. per 1000 cubic feet in London. In the manufacturing districts, where coal and labour are much less than in London, the cost will be reduced to about 5s.; and in gas-works and other places, where special facilities as to fuel, power, &c., exist, the cost will be still further lowered. The author went on to describe briefly the improvements which have been effected in the method of producing oxygen, and then proceeded to deal with its commercial applications.

On the subject of the use of oxygen in the purification of gas, as described by Mr. Valon in the paper above referred to, Dr. Thorne reminded his audience that where oxide of iron is employed for the removal of the sulphur from gas, the spent oxide is often revivified by being exposed for some time to the air—an operation which may be repeated ten or a dozen times before the oxide becomes finally spent. But in order to save the handling of the oxide thus made necessary, a small percentage of air is often added to the gas before it enters the oxide purifiers; and in this way the revivification is made continuous, till the oxide is finally completely spent. But when either of these plans is adopted, the purified gas is generally found to have lost somewhat in illuminating power, due probably to the nitrogen introduced in the added air. Mr. Valon's experiments were directed to ascertaining whether any material advantage would accrue by the substitution of a corresponding amount of pure oxygen for air. He found that not only did the loss of luminosity give place to a slight increase, and the revivification of the oxide proceed more regularly, but that the use of the oxide might be abandoned altogether; for when oxygen was employed in this way, the lime purifiers alone were found to efficiently remove the sulphur compounds—the issuing gas containing only from 6 to 8 grains of sulphur per 100 cubic feet. The proportion of oxygen found to give the best results was 0·10 per cent. of the volume of the gas for every 100 grains of sulphur per 100 cubic feet of crude gas. Under these conditions, the sulphur remained fixed in the lime (partly as free sulphur), and did not move forward when the lime became saturated with carbonic acid, as is the case where air is employed; and the life of the lime was nearly doubled. The lime lasts much longer than hitherto, owing to the more complete revivification of the lime; and when spent it has not the noxious smell of "blue billy," but forms an almost odourless and dry substance. The purifying space and plant is reduced by more than one-half, and the labour in proportion. The chemical explanation of these results, the author went on to say, must for the present be left unknown; but of the actual facts there is no doubt. Permanent oxygen plant has now been put down at the Ramsgate Corporation Gas-Works, where the process will shortly be at work.

In the course of the discussion which followed the paper, Dr. C. R. Alder Wright asked whether the "blue billy" shown by Dr. Thorne contained free sulphur or calcium sulphide, or whether the sulphur compounds in it had been oxidized to sulphate; and whether the action of the oxygen had been traced by the analytical examination of the product. Mr. C. T. Kingzett asked whether the oxygen used in the purification of gas prevented the formation of magnetic oxide of iron, which was the bugbear of the process. Mr. A. Wingham said he understood that the sulphur in the "blue billy" shown by Dr. Thorne, was in the state of free sulphur. If this was so, it seemed very remarkable that one should introduce oxygen into the gas and get a reduction. The probable explanation seemed to him to be that the oxygen, being introduced into the gas, burnt by preference a certain amount of sulphuretted hydrogen into sulphurous acid, which, reacting on the unburnt sulphuretted hydrogen, gave free sulphur—the lime acting simply as a mechanical filter. If this was so, the objection to the cost of lime would be overcome, as coke could be used.

In replying to the various questions, Dr. Thorne stated, with regard to gas purification, that there were many points at which a saving might be effected. In the first place, they might do away entirely with the oxide of iron. The saving in cost of oxide would be small, but the economy of space, handling, and so on, was by no means small. They would also be able to reduce even the quantity of lime used, and the space for the lime, by nearly one-half. Consequently there would be a further saving on the handling of lime. Then there would be appreciable economy in obtaining an increased luminosity, instead of a decrease, in the purified gas. Where oxygen was used, there was an undoubted increase of about half a candle in the illuminating power. This was no doubt due to a trace of oxygen left in the gas, which was not sufficient (the total quantity used being very small—only about 6 feet per 1000 cubic feet of gas) to appreciably increase the rate of consumption of the solid particles of carbon in the flame, but yet enough to raise its heat, and thus intensify the luminosity. Referring to spent lime in gas purification, he might say the sulphur was present partly as reduced sulphur, partly as sulphide, partly as sulphate, and partly only as sulphite. The relative proportions appeared to vary; but the actual ratios between them had not been much studied as yet. As far as could be judged, about one-fourth to one-half the sulphur was always in the free state; the remainder being in combination. As to the action of oxygen on oxide of iron, converting it into magnetic oxide, he could not give any information; their experiments having been directed in the first instance only to testing whether the increased action due to the oxygen was sufficient to make it worth using. They soon found that they were able to get rid of the oxide of iron; and their work after this turned exclusively to the examination of the purification by lime, and the products of the action of the oxygen had received but little attention. They based their hopes of saving by the oxygen process, as compared with the use of oxide of iron, in gas purification largely on economy in handling.

THE SOCIETY OF ARTS TRIALS OF MOTORS.

In the JOURNAL for the 12th ult. (p. 286), we announced the award, by the Council of the Society of Arts, of gold medals to the British Gas-Engine and Engineering Company, to Messrs. Crossley Bros., Limited, and to Messrs. Dick, Kerr, and Co., for the gas-engines sent in by them in competition for the prizes offered by the Society for the best motors suitable for electric lighting purposes. In addition to the foregoing, a Davy-Paxman compound portable steam-engine was submitted for trial, and gained a similar prize. The awards were made on the recommendation of Professor Kennedy, Dr. Hopkinson, F.R.S., and Mr. Beauchamp Tower, who were requested by the Council to test the motors. The report of these gentlemen has recently been published in the Society's *Journal*, with an introduction by the Secretary (Mr. H. Trueman Wood). It was briefly noticed in our "Electric Lighting Memoranda" last week; and we now give the portions thereof which relate to the trials of the three motors with which our readers are more particularly concerned.

In his introductory statement, Mr. Wood explains the circumstances under which the competition took place. In the autumn of 1886 the Council of the Society decided to offer medals for prime movers suitable for domestic installations for the electric light and other purposes. The details of the proposed competition having been considered by the Committee, an announcement was made in the following December that two gold medals would be awarded. The classification was intended to include motors of every class. The date fixed for sending in entries was Feb. 28, 1887. The entries received by that date were not considered sufficient in number to justify the Society in incurring the necessary expense; and the Council decided to postpone the date for the receipt of entries to the end of December, 1887. Certain alterations were made in the conditions of entry; and four gold and two silver medals were offered. Notice of this was sent to a large number of makers of engines in England and abroad. But the result, so far as the number of entries went, was far from satisfactory. Thirteen entries were contemplated; but only seven were actually received. Of these, three were withdrawn; so that only four engines were actually presented for trial. In spite of the small number of entries (fewer even than in the previous year, when there were eleven) the Council decided to proceed with their experiments; and the trials were successfully carried out in September last at South Kensington.

Facilities for conducting the tests were afforded by various firms, whose services the Council acknowledge; among them being Messrs. Alex. Wright and Co., of Millbank Street, Westminster, who lent some standard gas-meters, and whose representative (Mr. Richard Wright) rendered personal assistance. The Council are of opinion that the trials will prove to be well worth the cost and trouble incurred in carrying them out, and that the Judges' report thereon will be found of great scientific value. They think they are justified in saying that, as regards gas-engines, the experiments described in the report are the only thoroughly independent comparative tests of different engines that have been made with any approach to completeness over such long runs, and with such elaborate measurement of all the principal quantities concerned, as are therein set out.

The Judges, in their report, commence by stating that the three gas-engines tested were a Crossley 9-horse power nominal, a Griffin 8-horse power nominal, and an Atkinson 6-horse power nominal. The tests comprised an efficiency test during a six hours run for each engine at full power, a three-hours' run at half power, and a test running light. All the details connected with the tests are then described, and the construction and general arrangement of the motors are explained by means of diagrams.

Taking the three motors in their alphabetical order, we find that five experiments were made with the Atkinson engine. The first was a full-power trial extending over six hours. The mean speed of the engine was 131·1 revolutions per minute. The maximum speed for any quarter hour was 132·7 revolutions per minute; the minimum for any similar period 129·2 revolutions per minute.

The number of explosions per minute was 121·6; so that 7·2 per cent. of the explosions were cut off by the governor. The mean initial pressure was 166 lbs. per square inch above the atmosphere; but the mean effective pressure, owing to the great ratio of expansion employed, was only 46·1. The indicated horse power was thus 11·15. The brake horse power was 9·48; so that the mechanical efficiency of the engine reached 85 per cent. The horse power expended in driving the engine (the difference between the indicated and the brake horse power) was 1·67. The gas passed per hour through the main meter was 209·8 cubic feet, which is at the rate of 18·8 cubic feet per indicated, and 22·1 per brake horse power per hour. The addition of the gas used for ignition (4·5 cubic feet per hour) raises these figures to 19·2 and 22·6 cubic feet respectively. The proportion of heat turned into work was 22·8 per cent. The second trial was at half-brake power, and lasted three hours. The speed was the same as in the first trial. The engine ran at 129·6 revolutions per minute; its brake power being 4·74, and its indicated horse power, 6·59, corresponding to a mechanical efficiency of 71·9 per cent. The consumption of gas in the cylinder per indicated horse power per hour was 19·29 cubic feet, and per brake horse power per hour, 26·8 cubic feet. Taking into account the ignition gas, these figures become 20·18 and 28·10 cubic feet respectively. The heat turned into work was 22·3 per cent. In the third trial the engine was run for half an hour empty; the mean indicated horse power being 2·3. The gas used in the cylinder per indicated horse power per hour was at the rate of 20·5 cubic feet. The engine ran at 131·9 revolutions per minute. The heat turned into work corresponded to 21 per cent. of the whole heat of combustion. In the fourth trial the engine was run with about the full brake load, but at a lower speed than before—viz., 110·5 revolutions per minute. The brake horse power was 8·29; and the gas used in the cylinder per brake horse power, 22·75 cubic feet. In the fifth trial the speed was still further reduced to 100·5 revolutions per minute. The brake horse power was 7·08; and the gas used in the cylinder per brake horse power per hour, 22·29 cubic feet.

With the Crossley engine four experiments were made—the first at full power, the second at half power, the third empty, and the fourth to ascertain the power necessary to drive the countershaft with which the engine was fitted. The first experiment lasted for six hours continuously. The exhibitors elected to run under 15 brake horse power, and with 160 revolutions per minute. The actual mean brake horse power was 14·74; and the actual mean speed, 160·1 revolutions per minute. The greatest speed during any quarter of an hour was 161·8 revolutions per minute; and the least, 155·1 revolutions per minute. The engine ran quite cool throughout the whole trial. The indicated horse power for driving the engine was 2·38; and the mechanical efficiency reached 86·1 per cent. The gas used per indicated horse power per hour in the cylinder was 20·55 cubic feet; and per brake horse power per hour, 23·87 cubic feet. Taking into account the ignition gas, these quantities became 20·76 and 24·1 cubic feet respectively. The actual indicated work was 21·2 per cent. of the whole heat of combustion. The second trial lasted three hours. The engine ran at 7·41 brake horse power, at 158·8 revolutions per minute, with 41·1 explosions per minute. The indicated horse power was 9·73, so that the mechanical efficiency of the engine was 76·2 per cent. The gas used in the cylinder per indicated horse power per hour was 20·8 cubic feet; per brake horse power per hour, 27·34 cubic feet. Taking into account the gas used for ignition, these figures become 21·2 and 27·77 cubic feet respectively. The horse power expended in driving the engine amounted to 2·31. The amount of heat turned into work was 20·9 per cent. of the whole. In the third trial the engine was worked for half an hour empty. It ran at 161 revolutions per minute, and made 10·2 explosions per minute. The indicated horse power was 2·19. Gas was used at the rate of 2·38 cubic feet per indicated horse power per hour; and the work done corresponded to 19·4 per cent. of the heat of combustion of the gas used. The fourth trial, as already stated, was made for the purpose of finding the power expended in driving the countershaft only. This was found to be 1·9-horse power. This has to be deducted from the brake horse power of the first and second trials, in order to estimate the work which the engine could actually do against electrical resistances. The net brake horse power reckoned in this fashion comes, therefore, to 12·84 and 5·51 respectively; and the corresponding gas consumption per brake horse power per hour becomes 27·4 and 36·8 cubic feet.

The Griffin engine was submitted to four tests—the first, a six-hours' run at full power; the second, a three-hours' run at half power; the third, a short run with the engine empty; and the fourth, an hour's run at a somewhat higher speed and indicated horse power than in the first trial, and with altered valve-gear. The first trial corresponded to the similar trials of the Atkinson and Crossley engines, and observations were made in the same manner. The exhibitors elected to work at 200 revolutions per minute, and at a brake load corresponding to 12·5-horse power effective. The actual average speed throughout the trial was 198·1 revolutions per minute. The maximum speed for any quarter of an hour was 199·8 revolutions per minute; and the minimum, 192·7 revolutions per minute. The average number of explosions was 129 per minute; the brake horse power was 12·51. The mechanical efficiency was thus 80·9 per cent.; and the power used up in driving the engine itself, 2·96. The engine was fitted with two equal fly-wheels on which similar brakes were placed. The gas used in the engine was 350·2 cubic feet per hour; and for ignition, 7·1 feet. This corresponds to a gas consumption in the cylinder of 22·64 cubic feet per indicated horse power per hour, or 28 cubic feet per brake horse power per hour. These figures become 23·10 and 28·56 cubic feet respectively, if the ignition gas be also taken into account. The indicated horse power expended in driving the engine was 2·96. The heat turned into work was 19·2 per cent. of the whole heat of combustion. In the second trial the brake horse power was 6·30; or, as nearly as possible, half that of the first. All the other conditions were kept as nearly as possible the same. The quantity of gas used in the cylinder per indicated horse power per hour was 22·35 cubic feet; and per brake horse power per hour 36·3 cubic feet. These quantities become 22·92 and 37·2 cubic feet respectively if the gas used for ignition is taken into account. The heat turned into work was 19·4 per cent. of the whole. The speed of the engine during the trial was 201·8 revolutions per minute; the number of explosions per minute was 82·6. The brake horse power was 6·30; the indicated horse power, 10·23. The mechanical efficiency was, therefore, 61·6 per cent.; and the horse power expended in driving the engine, 3·93. In the third trial, the engine ran empty. Its mean speed was 200·1 revolutions per minute, with 30·6 explosions per minute. The indicated horse power was 3·84. The gas consumed per indicated horse power per hour was 24·79 cubic feet, or 25·91 cubic feet including the ignition gas. In this trial the indicated horse power corresponds to 17·5 per cent. of the whole heat of combustion of the gas used. During the fourth trial, which lasted for one hour, the engine was run at 206 revolutions per minute. The trial was made for the purpose specially of testing the working of the engine at a somewhat higher speed than before, and with a somewhat different arrangement of valve-gear. The indicated horse power was 16·39, and the brake horse power 13·39; the mechanical efficiency being thus 81·7 per cent. The horse power used in driving the engine itself was 3. The gas consumed per indicated horse power was 22·63, and per brake horse power per hour, 27·69 feet. These quantities become 23·05 and 28·21 cubic feet respectively, when taking into account the gas used for ignition. In this trial the indicated horse power corresponded to 19·2 per cent. of the whole heat of combustion of the gas employed in the experiment.

Particulars are next given of four trials of the Paxman steam-engine, and also of the speed trials; and in an appendix, Mr. C. J. Wilson, of University College, sets out the results of his analyses of the gas and coal employed in the tests—the apparatus used being described and illustrated.

Since the publication of the report, the letter of the Judges which accompanied it has appeared in the Society's *Journal*. In the course of it they explain that the performance of the Paxman engine, in point of economy of fuel, was in every way excellent, and its workmanship first-class. The Atkinson engine came into the first group of gas motors (under 10-horse power), and therefore did not compete directly with either of the other gas-engines. It attained a very high economy in gas consumption, and in other respects worked very satisfactorily. The Crossley and Griffin engines were both in the second group of gas motors (over 10-horse power), and therefore were in direct competition. The former engine, running upon the brake, without the countershaft, used much less gas per brake horse power than the latter. The Crossley engine, however, used so much power in connection with driving its contershaft, that the consumption of gas per horse power available for electric lighting was practically the same in both engines. The governing of the Griffin engine was distinctly better than that of the Crossley. In both cases the engines ran quite cool during all their trials; but the consumption of cylinder lubricant was considerably more in the Griffin than in the Crossley. Each of the three engines was tended by one man only during its trials. After consultation with the Committee of the Society, the Judges recommended that gold medals should be awarded to the Paxman and Atkinson engines, as being the sole representatives of a class, and having given exceptionally good results; and with regard to the other two engines, as the Crossley had the advantage in respect to economy of gas and of lubricant, and the Griffin in regularity of speed (both points of first importance), and considering the general excellence of both engines in other respects, they advised that similar awards should be made for them.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—In a previous number of the JOURNAL we gave an outline of the business at the first general meeting of this Association, which is to take place at Grantham on the 20th inst. We are now able to supplement that information by some definite particulars furnished by the circular which the Honorary Secretary and Treasurer (Mr. H. Wimhurst, of Sleaford) has just issued. The members will assemble shortly after noon at the gas-works, where refreshment will be provided. They will then adjourn to the Guildhall for the transaction of the business, which will principally consist in the delivery of the Inaugural Address by the President (Mr. W. Barratt, Engineer and Manager of the Grantham Gas-Works). In the afternoon, a visit will be paid to the well-known works of Messrs. Hornsby and Sons, Limited, which will be opened to the members and visitors through the kindness of the General Manager (Mr. F. C. Southwell). Subsequently the company will proceed to the Grantham Club, where, by invitation of the President, they will take tea. As the members attending the meeting have the privilege of being accompanied by friends, there will doubtless be a good gathering at the inaugural meeting of the youngest Association of Gas Managers.

Register of Patents.

GAS-FIRED POTTERY KILNS.—Holroyd, J., of Leeds, and Wilson, A., of Stafford. No. 3583; March 8, 1888. [8d.]

This invention relates to the combination of two or more gas-fired kilns with a single regenerator in which the air (or air and gas) is heated; each kiln being provided with two chambers, which act alternately as combustion chambers and channels for the exit of hot gases, and being in connection with two flues, each of which serves alternately as an inlet flue for hot air from the regenerator and an outlet flue for the products of combustion to the regenerator. In one arrangement two or more kilns are built side by side; and along one end there runs a flue or conduit communicating with a gas producer, and having a connection controlled by a valve to each combustion chamber, of which there are two under each kiln. Two other flues or conduits, running parallel with the gas flue, communicate with the two parts of the regenerator; and the combustion chambers of each kiln communicate respectively with the flues. There is a separate inlet which allows atmospheric air to be mingled with the gas on its way to the combustion chamber, if desired; this inlet being also provided with a valve.

GENERATING AND BURNING GASEOUS FUEL.—Avery, R. B., of New York. No. 4158; March 17, 1888. [8d.]

This invention relates to the construction of apparatus for generating and burning gaseous fuel for heating generating steam and like purposes. It consists in the combination with a closed fire-box, which forms a retort chamber, of a series of connected retorts or generating chambers; an air chamber, into which the generating retorts deliver, and wherein the gas is intermingled with the air which is to support combustion; and a burner to which the mixed air and gas are delivered for consumption. The superiority of this invention over others (according to the patentee) consists chiefly in the construction of the fire-box, which is funnel-shaped, and at the bottom of which there is a nozzle from which the gas enters and is injected into the fire-box. This box is lined with fire-brick; the top being arched with fire-brick, perforated with holes for the purpose of equally distributing the heat thus generated upon the retorts and superheaters.

The apparatus operates as follows:—Steam from a suitable source is admitted to a superheater, and from the superheater sent to an injector through a pipe, and also oil through another pipe. The superheated steam vaporizes and induces the flow of oil; and the two mingling form a vaporous combustible fuel, which flows through gas-generating pipes to a nozzle where—mingling with superheated steam from a pipe attached to the pipe leading from the superheater, and with air in an air or mixing chamber—the mixture passes to a burner, and is consumed in the closed fire-box. The generating pipes are gradually brought to an intense heat; and the mixture of steam and oil passing therethrough will in a short time cease to be a simple vapour, but will be converted into substantially a fixed gas, which, as it is delivered into the air or mixing chamber, will suck in and intimately mix with itself the air necessary to support combustion. The mixture, before it reaches the place of ignition, will thus be thoroughly heated; and the previous mixture of the air and gas, and the heating thereof to the point necessary for ignition or combustion, will produce an intense fire with the minimum amount of fuel, will prevent the loss incident upon chilling or cool drafts in the fire chamber and the deposit of soot, and will add to the durability of the devices themselves.

FLUID METERS.—Allmann, J.; communicated from E. Abegg, of Zurich, Switzerland. No. 4336; March 21, 1888. [8d.]

This invention relates to the construction of a fluid meter having an annular measuring chamber, with a reciprocating piston moving freely therein, and provided with a hollow slide-valve divided into two parts by means of a midfeather or its equivalent. The ports of the slide-valve and its chamber are so distributed that the transverse pressures on the slide-valve oppose and balance each other; the valve being actuated by the impact of the falling piston, so as to cause the relative positions of the inlet and outlet ports to be automatically reversed at the end of each stroke of the piston.

GOVERNING GEAR FOR GAS-ENGINES.—Crossley, F. W., of Manchester. No. 4624; March 26, 1888. [8d.]

For regulating the speed of gas motor engines, says the patentee, a governor has heretofore been employed, known as the "inertia governor," consisting of a lever carrying a weight pivotted on the slide-valve of the engine, and reciprocating with it; one arm of the lever being arranged so as either to hit or to miss the stem of the gas-supply valve. When the engine is working at normal speed, this arm at every stroke of the slide-valve hits the stem of the gas-valve; and, moving the valve in opposition to a weight or spring, admits gas to the engine cylinder. When, however, the speed of the engine is too great, the inertia of the weight upon the lever causes the arm to take such a position that it misses the stem of the gas-valve; and consequently there is no supply of gas until the speed of the engine becomes moderated. In many gas motor engines there is no slide-valve for admitting and igniting the cylinder charge; but, in lieu thereof, there is a lever worked by a cam which at the proper time opens a lift-valve for admitting to the cylinder the charge of air with or without gas. It is to this arrangement of valve gear that the present invention applies; the chief object of it being to utilize in a simple manner a single cam and lever for working the air-supply valve, the inertia governor, and the gas-supply valve.

For this purpose, according to one arrangement, on the cam lever above mentioned there is pivotted the inertia lever which may be of bell-crank form; its loaded arm extending forwards horizontally, and its other arm (which is a thin blade) extending upwards vertically under the stem of the gas-valve. This stem has a shoulder, against which the end of the blade abuts when the engine is working at normal speed; the upward movement of the cam lever in that case effecting the opening of the gas-valve as well as that of the air-valve. When the engine moves beyond its normal speed, the cam lever, rising rapidly, leaves the weight on the bell-crank lever somewhat behind; and consequently the blade arm of this lever is turned a little aside, so that in its ascent it misses the shoulder on the stem of the gas-valve, and fails to open that valve. The loaded bell-crank lever is subjected to the pressure of a spring, which can be adjusted (by a screw and nut) to overcome more or less of the inertia of the load, and so to determine the greater or less speed of the engine.

PURIFICATION OF COAL GAS.—Valon, W. A., of Ramsgate, and Brin's Oxygen Company, Limited, of Westminster. No. 6920; May 9, 1888. [6d.]

This invention has for its object, say the patentees, to effect the purification of coal gas "in a better or more efficient manner than hitherto; much less space and plant being necessary to effect the purification, and with economy in time and labour in manipulation."

There are no illustrations to this somewhat extended specification, the main portions of which are as follows:—According to this invention, oxygen is passed into or mixed with the gas; and the oxygen and the gas are then passed together through purifiers containing caustic alkali (preferably lime). The coal gas and oxygen must not, however, be passed into or mixed with the lime until after the tar and ammonia and like impurities have been removed—when the gas contains as impurities only carbonic anhydride and sulphur compounds. This reservation is important and essential to the invention for the reasons to be stated later on. The proportion of oxygen gas employed will vary according to the amount of impurities in the gas; but generally for every 100 grains of hydrogen sulphide present in each 100 cubic feet of the impure gas, 1 part by volume of the oxygen gas will be used for every 1000 parts by volume of the gas to be purified. Care must be taken to remove the tar and ammonia and like impurities before the oxygen is admitted, as otherwise the resultant material in the lime purifiers would be unmarketable. It would have the offensive odour of "blue billy," together with the pungent odour of ammonia; and it could only be removed from the purifiers, and otherwise manipulated, after the greater part of the free and loosely combined ammonia had been released. Moreover, if the tar and ammonia and like impurities be not first removed, the sulphate of ammonia and a considerable part of the tar would be lost; and the spent lime would form a dark coloured moist and more or less granular mass impregnated with a considerable amount of tar, and of very small manurial value. When freshly taken from the lime purifiers, the spent lime would contain only 3 to 4 per cent. of ammonia; and a great part of this would be so loosely combined that, when the lime is exposed to the air for a short time, about two-thirds of the ammonia would become dissipated—in part set free by the caustic lime present in the spent lime—and by the time the spent lime was available as manure, it would contain only 1 or 1½ per cent. of ammonia. It would thus be practically valueless. Further, if such spent lime be kept in bulk, intra-molecular change takes place; and the whole soon becomes a pasty mass of offensive odour, evolving ammonia. Moreover, no ready test would be applicable to determine when the lime purifier was exhausted; and some such test is essential to the practical working of such a process. Further, the lime would become fouled in the purifiers much more quickly in the presence of the tar, ammonia, and like impurities; and thus the often-repeated self-revivification which takes place in the process according to the present invention would be prevented. The spent lime—the product of the process according to the present invention—forms a dry and almost odourless mass, containing from 10 to 12 per cent. of sulphur, most of which can be profitably recovered. Or at the least this spent lime would be suitable for use as road ballast, or the like; and when it is kept in bulk, no apparent change occurs. In the process according to the present invention, the carbonic acid test forms an easy means of ascertaining the state of the lime in the purifier; and the resultant spent lime, being odourless, can be readily manipulated and removed.

The reactions which take place owing to the use of oxygen gas in the process according to the present invention are, it is believed, as follows:—The calcium hydrate (presuming for the purpose of this example that lime is the alkali used) takes up the sulphuretted hydrogen from the impure gas, and forms a sulphide of calcium; and this, in its turn, acts upon the sulphur compounds other than sulphuretted hydrogen. The sulphide and other sulphur derivatives of calcium are re-oxidized by the oxygen, which has been passed into and mixed with the gas according to this invention, and are in great part revivified by being transformed into calcium hydrate; the sulphur being in great part separated as free sulphur. This calcium hydrate is also capable of absorbing the carbonic anhydride, with formation of carbonate of lime as in the usual method of purification by lime. These reactions take place practically simultaneously. The complete saturation of the lime by the impurities is readily indicated by carbonic anhydride being detected at the outlet of the purifier in quantity equal to, or approaching that in which it is present at the inlet; and when this is found to be the case, the purifier should be put out of action, as the purifying power of the lime is then exhausted. The exhausted lime in the purifier consists mainly of carbonate of lime, free sulphur, and sulphur derivatives of lime. The sulphur may be recovered and the lime revivified by any suitable method.

By the process according to this invention, both sulphuretted hydrogen or other sulphur compounds and carbonic anhydride are by one operation almost completely removed from the impure gas.

The use of oxide of iron may be dispensed with when the gas is purified according to this invention; and consequently the space and plant necessary for effecting the purification of the gas may be materially reduced, and a less quantity of lime is required than is needed in purification as hitherto conducted. The exhausted material from the purifier, too, has no unpleasant odour; and beyond these advantages the process presents the great additional advantage that the illuminating power of the gas is increased by the process of purification instead of being decreased, as is the case when the process is carried on by the use of atmospheric air, as has hitherto been done. This is due, it is believed, to the fact that nitrogen is not present in any appreciable quantity when oxygen is used; the nitrogen present in the air employed in the process mentioned having the effect of decreasing the illuminating power of the gas.

The inventors wish it to be understood that they do not claim the use of atmospheric air in purifying gas, nor the supply of oxygen to the crude gas coming from the retorts, and before the tar, ammonia, and like impurities have been removed. It is also to be understood that they do

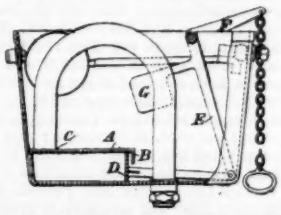
not limit themselves to the use of lime, as other suitable alkali can be used (as will be readily understood by chemists). The oxygen may be stored in a holder and supplied to the gas on its way from the washers to the lime purifiers, the pipe being provided with valves for controlling the passage of the oxygen; or the gas to be purified in the lime purifiers and the oxygen gas may be independently admitted into the inlet end of the lime purifiers.

MANUFACTURE OF ILLUMINATING GAS AND COKE.—Westman, G. M., of New York. No. 17,337; Nov. 28, 1888. [8d.]

The object of this invention is to manufacture illuminating gas and coke from coals by "passing through the coals superheated gases of the same quality as those produced from the coals." In the manufacture of illuminating gas and coke as heretofore practised (says the patentee) the coals were gasified in retorts; but in this process the coals are treated in a shaft furnace which serves as a gas producer. The coals are periodically charged in at the top; and the resultant coke is periodically withdrawn at the bottom without interrupting the process. The principal advantages derived are said to be a great saving of labour and a considerable increase in the quantity and improvement in the quality of the gas obtained from the coals. The process is preferably carried out by making part of the gas produced, after being superheated in a regenerator, circulate back into the furnace containing the coals, as well as by leading the gas through glowing coke when leaving the producer.

WATER-WASTE PREVENTER.—Bocock, R., of Lincoln. No. 17,351; Nov. 29, 1888. [6d.]

In this syphon flushing-cistern for water closets, a container plate A, is fixed parallel to the bottom of the cistern; resting on a projection at the end and sides, and having a 2-inch space between. The plate has a



1-inch lip on the front edge B; and an outlet to the syphon C in one corner. Under the plate is a vertical oblong sliding-plate D, with an arm pivotted on the lever E. On pulling down the handle F, it pushes the plate D horizontally past the outlet C; forcing the water over the crown of the syphon, and causing a suction which holds the sliding-plate D in position, until the flush has ceased—having emptied the cistern down to the edge of the lip B—when the weight G slides the plate D back to its normal position. As soon as the discharge has taken place, the cistern is refilled by means of a ball-tap; the water finding its way into the container.

MANUFACTURE OF WATER GAS.—Bate, W. T., of Conshohocken, Penn., U.S.A. No. 18,027; Dec. 11, 1888. [11d.]

This invention relates to apparatus in which gas is produced by decomposing steam, mixing hydrocarbon vapour therewith, and "fixing" the gas by effecting the intimate commingling of the decomposed steam and oil vapour, under intense heat; the invention comprising certain improvements in the details of construction of apparatus of this character. One of the objects sought is to prevent excessive heating of the casings of the fire-place and superheater. Another, to so construct the top of the metal casing of the fire-place or superheater, that the application of the brick lining thereto can be readily effected, and the joints in the metal casing protected. Other objects are: To provide means for readily effecting the vaporization of the oil and superheating of the steam, before they are commingled in the flues of the apparatus; to effect the intimate commingling of the steam and vapour in the flues; to prevent injury to the caps or covers of the passages in the superheater; to economically construct the lining of the superheater; to provide effective means for operating the valves which control the supply of air to the fireplaces of the apparatus; and, finally, to provide for the ready removal of tar from the wash-box, and prevent the unsealing of the gas-pipes which terminate in this box.

INCANDESCENT GAS-BURNERS.—Hooker, W., and Murray, D., of Sydney, New South Wales. No. 19,055; Dec. 31, 1888. [6d.]

In this invention the burner is turned downwards and not upwards as is usually the case. In order to prevent the fusing of the end of the bracket or supply-pipe to which the burner is to be attached, there is inserted into the extremity of the pipe or bracket a small porcelain tubular connection, which near its lower end has an annular groove, so that the burner itself may be secured to it by platinum wire. The burner itself is composed of a thin piece of platinum, irregularly perforated with a great number of fine holes. It is shaped preferably with a grater-like surface outside, and its open end is placed over the free end of the porcelain connection, and secured in position. It is asserted by the patentees that, when the gas is lighted, a lambent flame will commence to play round the burner, disappearing, however, as the heat develops; and, after a short space of time, the burner will become heated to incandescence, and a brilliantly white, but soft light produced.

APPLICATIONS FOR LETTERS PATENT.

3293.—AHRBECKER, H. C., "An improved liquid-meter." Feb. 23.

3317.—SIMMS, W., and HOUGHTON, E., "Improvements in gas-furnaces." Feb. 25.

3366.—WENHAM, F. H., "Improvements in gas-lamps." Feb. 25.

3391.—HISLOP, G. R., "Improvements in apparatus for charging gas-producers and gas or shale-oil retort furnaces with hot residual coke." Feb. 26.

3447.—BOWEN, F. E. W., "Improvements relating to gas and oil burners." Feb. 26.

Correspondence.

[We are not responsible for the opinions expressed by Correspondents.]

THE GAS INSTITUTE.

SIR,—Many suggestions have been offered as to the best mode of reforming The Gas Institute, and, among others, that of "leaving out the trading element" altogether; but as to what this really means, no explanation is given. If, however, it refers to persons engaged in the manufacture of gas apparatus as distinct from those engaged in the manufacture of gas, it ought to be very maturely considered whether this is not more likely to be prejudical than otherwise to the object proposed and to the gas industry generally, which requires more than anything else the hearty co-operation of all parties interested directly or indirectly. The shareholders in gas undertakings and the consumers of gas have greatly benefited from time to time by the economy of manufacture resulting from the discussions thereon at the meetings of The Gas Institute hitherto, and doubtless other benefits equally advantageous to both parties would result from similar discussions as to the best mode of constructing apparatus for gas purposes and instructing the public as to the various uses to which gas can be applied.

It seems, therefore, on reflection, that it would be more conducive to the reforming of the Institute, and to the bringing all parties together again, to incorporate the trading element, and make it a part of the Institute with the same privileges as all the other members, than to exclude it from the Institute in the manner proposed. A day might be set apart specially for discussions upon these points, without prejudice to the others; and anything useful to the public might be communicated to the papers. Persons engaged in the manufacture of gas apparatus are as much interested in extending the use of gas as the companies themselves. It seems, therefore, inconceivable that their joining the Institute could be prejudicial to it. It would surely be more to the benefit of all interested for both parties to work together, than for some of the company to say: "You go your way, and we will go ours."

The irregularities which have caused the present disruption of the Institute might easily be avoided for the future by making rules suitable for the purpose.

WM. LIVESEY.

Gas Companies' Association, Palace Chambers, Westminster, March 4, 1889.

THE DINSMORE GAS PROCESS.

SIR,—A pamphlet has been sent to me on this process, in which I find the following statement:—

"Gas made per ton of coal carbonized . . . 12,275 cub. ft.
Average illuminating power . . . . . 22·18 candles
Quantity of tar used per ton of coal carbonized . . . . . 7 gallons

The coal used was Arley Mine nuts, producing in the usual way 10,500 cubic feet of gas of 15 or 16 candle power."

After reading Mr. Dinsmore's letter in your last issue, I think it is only fair to ask him to reconcile this statement with the following figures:—

Gas made by the ordinary process—		
10,500 cubic feet, 16 candles = Weight	366	lbs.
Gas made by Dinsmore's process—		
10,500 cubic feet, 22 candles = Weight, 431 lbs.		
Additional 2000 feet " " 82¼ "	=513¼	"
Difference in weight between 10,500 cubic feet of 16-candle gas and 12,500 cubic feet of 22-candle gas	147¼	lbs.
Original weight of 7 gallons of tar	80	"
	67¼	lbs.

This seems to show an increase of 67¼ lbs. in weight during the process of carbonization, without any deduction for coke drawn from the duct. Where does it come from?

WILLIAM A. VALON.

Ramsgate, March 8, 1889.

DESIGNING GASHOLDERS.

SIR,—The letters of your correspondents and the articles in the JOURNAL make it difficult to judge what is the true meaning and definition of the word "engineer." James Watt, Henry Maudslay, George Stephenson, Sir Joseph Whitworth, John Penn, Sir William Fairbairn, and James Nasmyth, who may fairly be described as among the chief founders of modern engineering science—whose names are historical in engineering invention and constructed all over the world, as well as in Westminster Abbey—were all "contractors," and not engineers at all, if the views and definitions of your correspondents are correct; for they one and all took and carried out engineering works by contract for the most part during the largest part of their lives. Coming down to more recent times, the great modern engineering firms of the North—for example, Sir William Armstrong, Mitchell, and Co., John Elder and Co., Sir William Pearce, Laird and Co., the Palmers, Thomsons, Napiers, and the Macgregors, with others, are in the front rank of naval architecture and engineering, who have made the reputation of England for engineering foremost among all the nations of the world, and whose works and drawing offices are among the chief schools of instruction for producing trained engineers—are nothing more, in the estimation of your correspondents, than mere "contractors," or, as others say, "traders." To show the absurdity of these views, it is a fact that the Admiralty complain most bitterly that, no sooner does an engineer of pronounced ability become apparent in the Government service, than it is found impossible to retain him, because of his being inevitably decoyed away by the superior advantages offered to him by the great engineering firms of the North; leaving the Government, with all its privileges, pensions, &c., to enter their service.

Now, I am inclined to think that the designs of these "contractors and tradesmen" of (for example) a first-class vessel of war—having a displacement of 10,000 to 12,000 tons, the colossal mass of ironwork driven through the ocean with a speed of 18 knots an hour, with all its steam machinery, its heavy guns and machines to work them, its numerous engineering appliances of all kinds, costing a million of

money—must certainly be equal to a design of the best telescopic gas-holder. So that it appears that these things are, and have always been, common to all other branches of engineering, as well as to gas engineering. If Government send a design for a vessel of war to these engineers, contractors, or traders, they send their tender for its construction. If the Government ask them for a design and price, they furnish it, exactly as James Watt, Henry Maudslay, John Penn, and James Nasmyth did in former times; and as gas engineers do now.

It is said that "truth is stranger than fiction;" and surely the immortal Pecksniff in Martin Chuzzlewit never went so far, or took such extreme views as to his "professional position," as the writers of some of the communications which have recently appeared, in their attempted disparagement of men, many of whom are known to be of the highest scientific culture, combined with the most striking originality and unsurpassed ability and probity, who have declined to accept engineering work in any other way than by contract, and who have spent their whole lives in the exercise of the same.

CONTRACTOR.

March 8, 1889.

PIGGOTT'S GASHOLDER CUP.

SIR,—So many theoretical objections, not exactly of the soundest character, have been urged against Piggott's cup, that just one good reason in its favour may possibly be of service. The first cup of this kind that was made was applied to the No. 9 gasholder (110 feet in diameter by 30 feet deep, in two lifts) at the Old Kent Road in 1862. It has been in constant use from that time, has never given any trouble or needed any repairs, and is now in such good condition that it will undoubtedly last out the holder (which has probably a further 25 years of life), and may even then be fit to be used again. In my experience, this form of cup is the best, the strongest, the most durable, and the most suitable for the *secure* attachment of the roller carriages, and the simplest that has ever been introduced—a credit to its inventor, and a source of satisfaction to those who use it.

GEORGE LIVESEY.

Tunbridge Wells, March 7, 1889.

THE CLAUS SYSTEM AT THE BELFAST GAS-WORKS.

SIR,—The paragraph in Mr. T. B. Ball's Inaugural Address at the meeting of the Manchester Institution on the 2nd inst., in which he refers to the trial of the Claus apparatus in Belfast, requires slight orrection. We do not use steam-jet exhausters. Our condensers are, however, entirely on the Körting-Cleland system in that section of the works where this experiment is being tried; and as by these condensers almost all the ammonia is removed from the gas, only a very small quantity is found at the inlet to the Claus apparatus. Hence the accumulation of ammonia was very slow. After working for something like a month, we have left off this apparatus, in order to make good some slight leaks which were giving us trouble. In about a week from this date, I expect we shall be ready to make a fresh start; and I have every reason to hope for a successful result.

J. STELFOX.

Belfast, March 6, 1889.

GAS-MAINS AS ELECTRICAL CONDUITS.

SIR,—Referring to the paragraph on this subject in the JOURNAL for the 19th ult. (p. 346), I may say that the late Mr. A. A. Croll had an electric wire laid from the works of the Great Central Gas Company at Bow Common to the Company's offices in the City. Having had to do with the laying of this, I may state that it was the ordinary copper wire, covered with gutta-percha. In laying, the wire was coiled on an iron reel that would just roll along the 26-inch main. The reel was passed through the syphon covers, the workman followed, and made the junctions inside the main; the insulation being tested as the work proceeded. This appliance was used for messages for a period of several months; but currents of gradually increasing strength were required, until they failed altogether.

G. B. IRONS.

Gosport, March 8, 1889.

THE OIL LIGHTING AT ERITH AND WIMBLEDON.

SIR,—One object I had in view in writing to you recently on the subject of public lighting by oil, was to assure managers of gas companies in the provinces that they have nothing to fear from it, as a competitor with gas, in the long run. Public lamps are wanted in the winter (in the summer nobody cares much whether they are alight or not); and during the winter oil does not appear to be able to compete with gas successfully for reliability. Last Thursday evening, 12 lamps in the Merton Road, Wimbledon, were not alight at 7 p.m.; and a similar thing occurred about a week ago at the same place. It was a very windy and rainy evening, and illustrated the difficulty the lamplighters have in carrying long ladders on boisterous evenings, and taking off the chimneys and lighting the lamps with matches. They cannot "come up to time;" and on Sunday evening last, one lamp on the Hill Road, Wimbledon, collapsed during the frost, and left in darkness that part of the principal thoroughfare. These facts came under notice in a casual 20 minutes' walk from my residence. I did not perambulate the district to see how many dozen lamps were not alight. As to Erith, the Chairman of the Local Board again reports this week that 98 lamps were not alight during the three weeks ending the 1st inst. That is to say, that since the Defries Oil Company agreed to allow £13 to be deducted from their account for 104 lamps not alight (in addition to the 90 the Local Board forgave them during the first three months of their contract), *an additional* 98 *lamps have gone out this wintry weather in three weeks.* Further, the most determined advocate of oil public lighting a year ago was the staunch advocate on Monday last to have the fountain lamp at Belvedere *lighted with gas again;* and the Clerk was instructed to write to Mr. Defries that if he could not keep this large lamp alight at this dangerous spot, where six roads meet, the Local Board would have to apply to the West Kent Gas Company to light it with gas, or hold him responsible for any accident occurring from the lamp not being alight. Where is the vaunted success of oil public lighting? Not at Erith yet, nor at Wimbledon. I may add that the Gas Company had a large four-burner lamp at the Belvedere fountain alight from sunset till daylight for several years, even until the 5th of December last year, and it was never reported to me as having failed once during that period. At the last meeting of the Erith Local Board, it was reported that the Defries Company did not appear to be able to keep this lamp alight continuously.

In my opinion, the existence of the advocates of oil public lighting upon the stage of the Erith Local Board depends upon the success of this experiment; and they will be compelled to enforce the fines to get the lamps kept alight. If that is an impossibility, and the scheme is a failure, they will get swept off the platform, to make room for another set of actors. In my first letter in the JOURNAL, in August last, I stated that we had not heard the last of the Local Board and their oil public lighting scheme; but I did not expect that at so early a period the stoutest champion of oil public lamps would have been so warm an advocate for gas to be replaced at this Belvedere fountain lamp. The Oil Company has had nine months to experiment; and they do not appear to be able to keep the oil lamps alight with any more success during the last three months than during the first. To my gas brethren in the provinces, therefore, I again say, "*Nil desperandum.*"

R. P. KEYS.

Wimbledon, March 9, 1889.

P.S.—There is a Defries oil-lamp close to the offices of the local newspaper; and, after witnessing its vagaries for nine months, the Editor has, in a recent issue, dubbed the lot *Smoky Doubtfuls*—a *sobriquet* infinitely more biting and sarcastic than anything I have written. The caustic is applied with such an oily, unctuous covering that even the advocates of oil receive it without a twinge of pain. "Smoky doubtfuls!"—is it not grateful to our ears?—R. P. K.

WATER SUPPLIES AND LEAD POISONING.

SIR,—In the JOURNAL for the 5th ult. (p. 248), your correspondent Mr. G. A. Hall, in his letter on the above subject, makes an assertion without supplying any evidence to build up the theory broached. There is such a diversity of opinion as to hard and soft water as used for dietetic purposes, that one is bewildered as to which of the experts may be correct. Mr. Baldwin Latham stated at the conference on water supply held at the International Health Exhibition, that "many authorities insist that, for the sake of health, a soft water is beneficial; on the other hand, there are those who contend that there is no evidence whatever to show that a hard water has any influence upon health." In making the assertion that soft waters are deleterious to health, and capable of dissolving large quantities of lead, the analyses of the various towns' supplies of water should have been given and the high death-rates of such places proved to have been owing to the population drinking a poisoned supply. Even the water supply in the town mentioned by Mr. Hall has been stated by its eminent chemists to be a good potable water; while others decry it as being likely to poison the population. What your correspondent should undertake to do, before making such a positive statement, is to tabulate the towns suffering in the manner indicated, and supply analyses of the waters as far as they can be obtained, so that your readers may be in a position to form a definite conclusion as to the belt line running throughout Great Britain of the pure water supply, as well as that which carries "a new population of a lower type" more minute in size than the myriads of organisms found in the running brook, "and called by the bacteriologist *schizomycetes.*" If Mr. Hall will kindly give the names of towns supplied with this poison, and other information in his possession, with facts proving that efficient sound filtration will not remove vegetable growth, and that "polarite" does absolutely burn up the peaty infusion and remove lead, it will be an advantage. An assertion of this sort is good as an advertisement for "polarite." I have seen similar statements made in the JOURNAL years ago in regard to other substances; but I cannot find anything beyond a few laboratory experiments. Therefore, unless your correspondent can supply a proper number of examples of towns suffering from a high death-rate, and proved statistics as to the value of "polarite," it must be placed in the same category with "carbalite," spongy iron, hydrate of barytes, phosphate of soda, and hundreds of other substances, patented for the filtration, softening, and purification of water. Is "polarite" the same substance as feral-carbon?

FILTRATION.

March 6, 1889.

THE SPECIFIC GRAVITY AND ILLUMINATING POWER OF GAS.—Mr. N. H. Humphrys writes to say that the question asked by a "Student" in last week's JOURNAL (p. 439) will be fully answered in the course of the next few articles on "The Chemistry of Gas Lighting" now appearing in our columns.

FAILURE OF OIL LIGHTING AT OLD BROMPTON, KENT.—An experiment with oil lighting which the Gillingham Local Board have recently carried out at Old Brompton, Kent, has proved a complete failure; and when the matter came up for discussion at the meeting of the Board last Friday, Mr. Stokes reported that if the illuminating power of the oil-lamps put up by the Defries Safety Lamp Company was equal to 20 candles, then the gas-light which they had was equal to 40 candles. Mr. R. Sheepwash said oil lighting at Old Brompton had proved as great a failure as it had done at Gravesend. Mr. B. H. Sheepwash proposed that the tender of the Rochester Gas Company at £2 7s. per lamp per annum where the standards belong to the Board, and £2 13s. where they are the property of the Company, be accepted. Mr. A. Mackay seconded the resolution, and it was carried unanimously.

THE PROPOSED NEW GAS-WORKS FOR ROTHERHAM.—The Gas Committee's minutes presented at the meeting of the Rotherham Town Council last Wednesday contained a recommendation that a Sub-Committee, consisting of the Chairman, Vice-Chairman, and Messrs. Habershon, Corker, Stoddart, Winter, and Hickmott should be appointed to consider the question of the purchase of a site for the new gas-works, and the carrying out of Mr. T. Newbigging's report (an abstract of which appeared in the JOURNAL for Sept. 4 last). The resolution for the adoption of the minutes having been moved and seconded, Alderman Gummer proposed that the matter be referred back to the Committee, remarking that the labours of the Sub-Committee would be useless and an unnecessary waste of their time. He criticized the present management of the gas-works; saying that they ought, before building new works, to make the best use of the present property, which he contended was not being done. Mr. Cox seconded the amendment, arguing that it was quite an easy and simple matter to provide additional purifying power on the present site. On a vote being taken, nine were in favour of the amendment, and eight against; and therefore this portion of the minutes was referred back to the Committee.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 4.

The Examiners reported that the further Standing Orders applicable to the following Bills have been complied with:—Bristol Water Bill, Newcastle and Gateshead Water Bill, Yeadon Water Bill.

The following Bills were read a second time:—Belfast Water Bill, Bury Corporation Bill, Deanhead Commissioners Bill, Manchester Corporation Bill, Newry Improvement Bill, Padiham and Hapton Local Board Bill, Wakefield Corporation Bill.

TUESDAY, MARCH 5.

The Examiners reported that the further Standing Orders applicable to the following Bills have been complied with:—Plymouth Dock (Devonport) Water Bill, Eastbourne Water Bill, Windermere District Gas and Water Bill.

The Burnley Corporation Bill and the Coventry Corporation Water Bill were read a second time.

THURSDAY, MARCH 7.

The Examiners reported that the further Standing Orders applicable to the Cleveland Water Bill have been complied with.

The Bristol Water Bill, the Newcastle and Gateshead Water Bill, and the Yeadon Water Bill were read a second time.

Petitions were presented against the Belfast Water Bill, from the Trustees of the Marquis of Downshire; and against the Newcastle and Gateshead Water Bill, from the Conservators of the Fishery District of the River Tyne.

FRIDAY, MARCH 8.

The Examiners reported that the further Standing Orders applicable to the Rastrick Water Bill have been complied with.

The Windermere District Gas and Water Bill was read a second time.

Petitions against the Manchester Corporation Bill were presented from the Corporation of Hyde and the Hyde Gas Company; and against the Newcastle and Gateshead Water Bill, from the Corporation of Newcastle-upon-Tyne.

HOUSE OF COMMONS.

MONDAY, MARCH 4.

The Examiners reported that Standing Order No. 62 has been complied with in the case of the Morley Gas Bill; and No. 63 in the case of the Great Wigston Gas Bill and the Kettering Water Bill.

The following Bills were read a second time, and committed:—Cheltenham Improvement Bill, East Kent District Water Bill, Edinburgh and District Water Bill, Heywood Corporation Bill, Scarborough Improvement Bill, South Kent Water Bill, Swansea Corporation Bill, Wigan Borough Extension Bill, Woodhall Spa Company Bill.

On the motion of Mr. T. W. RUSSELL, a copy was ordered of memorials from shipowners of various ports in the United Kingdom, with the signatures thereto, asking for further inquiry into the report of the Trinity House on the South Foreland experiments on lighthouse illuminants, and addressed to the Marquis of Salisbury as Prime Minister, and by him referred to the Board of Trade; and also the correspondence which has taken place on that subject between the Board of Trade, the Trinity House, Professor Stokes, M.P., President of the Royal Society, and Mr. J. R. Wigham on his own behalf and on behalf of shipowners and others interested in the question (in continuation of Parliamentary Paper No. 70 of session 1888).

TUESDAY, MARCH 5.

The Examiner reported compliance with Standing Order No. 63 in the case of the Faversham Gas Bill.

The Liverpool Corporation Bill and the Long Eaton and District Water Bill were read a second time, and committed.

Petitions were presented against the Garw Water Bill, by the Agmore Gas and Water Company; and against the South Kent Water Bill, by the Wrotham Local Board and the Maidstone Rural Sanitary Authority.

The return moved for by Mr. T. W. Russell relative to the South Foreland Lighthouse experiments (*vide supra*) was presented.

THURSDAY, MARCH 7.

Petitions were presented against the following Bills:—Cheltenham Improvement Bill, from the Cheltenham Gaslight and Coke Company; Garw Water Bill, from the Bridgend Gas and Water Company and the Agmore and Garw Local Board; Metropolitan Electric Supply Bill, from the London Electric Supply Corporation; Swansea Corporation Bill, from the Oystermouth and District Water Company; Wigan Borough Extension Bill, from the Hindley Local Board.

FRIDAY, MARCH 8.

Application for leave to deposit a petition for a Bill was made by the Belgrano (Buenos Ayres) Gas Company.

Petitions against the following Bills were presented:—Barrow Hæmatite Steel Company (Water) Bill and Barrow-in-Furness Corporation Bill, from the Conservators for the Fishery District of the Rivers Kent, Bela, Winster, Leven, and Duddon, the Millom Local Board, and the Dalton-in-Furness Local Board; Metropolitan Electric Supply Bill, from the Strand District Board of Works; Rickmansworth and Uxbridge Valley Water Bill, from the Uxbridge District Local Board, the West Surrey Water Company, the Grand Junction Water Company, and the Conservators of the River Thames; West Ham Gas Bill, from the Leyton Local Board; Wigan Borough Extension Bill, from the Pemberton Local Board and the Ince-in-Makerfield Local Board.

SATURDAY, MARCH 9.

Petitions against the following Bills were presented:—Barrow Hæmatite Steel Company (Water) Bill, from the Corporation of Barrow-in-Furness; Barrow-in-Furness Corporation Bill, from the Barrow Hæmatite Steel Company, Limited; Cheltenham Improvement Bill, from the Leckhampton Local Board; East Kent District Water Bill, from the Corporation of Sandwich; Kettering Water Bill, from Mr. C. H. Maunsell and Mr. W. R. Rose; Liverpool Corporation Bill, from the Corporation of Bootle-cum-Linacre; Long Eaton and District Water Bill, from the Long Eaton Local Board; Metropolitan Electric Supply Bill, from the Metropolitan Board of Works, the Vestry of Marylebone, and the Electrical Power Storeage Company, Limited; Rickmansworth and Uxbridge Valley Water Bill, from Owners, &c., of mills, &c., on the River Colne, and the South-West Suburban Water Company; Swansea Corporation Bill, from the Swansea Gas Company, the Swansea Rural Sanitary Authority, and the Oystermouth Local Board; West Ham Gas Bill, from the Corporation of West Ham.

Miscellaneous News.

THE LONDON COUNTY COUNCIL AND THE COAL AND WINE DUES.

At the Meeting of the London County Council last Tuesday, the question of what action the Council should take in regard to the coal and wine dues was under discussion.

Mr. C. HARRISON moved—"That the London County Council do forthwith give notice to the Metropolitan Board of Works of their intention to oppose the London Coal and Wine Duties Continuance Bill, stated in the report of the Metropolitan Board of Works of the 31st of December, 1888, as about to be introduced into Parliament by the City of London Corporation in conjunction with the Board of Works; and that copies of the resolution (if passed) be forwarded by the Chairman of the Council to all the members of the House of Commons." He said the question of the coal tax had been one which had been fully inquired into and very much objected to; and he brought forward his motion as a protest against the ninth renewal of the ¾d. tax which was imposed 196 years ago to enable the Corporation to pay its creditors, and against the sixth renewal of the tax which was put on in 1807 for the building of the Coal Exchange. He also proposed it as a protest against the 4d. tax claimed by the City as a matter of right and as part of its property, which tax had, by a series of statutes, been joined on to the ¾d. tax, and hitherto applied for public improvements. The opposition to the abolition of the dues came chiefly from the City. It was a matter of the greatest importance to them, because, although the City had no power of rating except in respect of sewers and police, the charges on their other funds were so heavily mortgaged that there was no balance to meet charges and carry on the Corporation and the civic government as they had done hitherto. The Corporation would therefore struggle for a continuance of the dues. The duty of 1s. 1d. upon the quantity of coal consumed in each tenement in the City was rather more than double the amount the 2d. rate would produce.

Mr. LLOYD seconded the motion.

Mr. A. HOARE moved, as an amendment—"That the Bill introduced into the House of Commons by Mr. Baring [see *ante*, p. 392] be referred to the Parliamentary Committee for consideration and report." It would, he thought, be an act of precipitancy if the Council were to pass such a resolution as that of Mr. Harrison without most careful consideration. A sum of great magnitude was involved. The total revenue from the coal dues was now about £450,000, of which they might say that £370,000 belonged to London proper—the London represented by the Council—and the other £80,000 would be returnable to the extra-Metropolitan area. The total consumption of coals in London was 9,000,000 tons; and of this the Gas Companies consumed about 2,400,000 tons. If they presented the gas interest with something like £70,000 or £80,000 a year, he did not think it would be a judicious piece of finance. The Gas Companies would not get the whole of the profit; but the poorer classes in London, for whom he considered he was pleading, would not derive any advantage from the cheapening of gas. It was stated that the coal dues were a burdensome tax upon London manufactories. Under the influence of the dues, London had grown at the rate of 400,000 inhabitants in every ten years. He thought a growth at this rate did not point to any very marked evil influence of the dues; and it would be difficult to understand how a tax of this value could have any such effect. He looked on this matter as one of London finance. The rates of London had reached a point at which they could not well be increased; and it was essential for their own success, and the improvements for which the people of London looked to them, that they should have a subsidy of something like half-a-million per annum from other sources. A gentleman near him suggested ground-rents. He had nothing to say against the taxation of ground-rents; but it would not be a very easy matter, especially as Parliament was at present constituted. If the coal dues were dropped, and they failed to get a substituted tax, the consequence would be that they would find themselves crippled in undertaking London improvements. If the dues were removed, the coal-owners would be able to raise the price of coals, and the railway companies and the coal-owners would be benefited. They were there not to consider the coal-owners of the North, but to safeguard the interests of the people of London, and of the poorer classes more especially. Although he asked for half-a-million, he should not be disinclined to accept £9000 or £10,000 a year; and this was the amount annually yielded by the wine dues, which he thought they need not sacrifice, even though the coal dues were not renewed. He opposed the notion that the grants in relief of local taxation allowed by the Government were at all a substitution for the coal dues; and he concluded by making a suggestion, which, he said, he took from one of the speeches of the Chairman (Lord Rosebery), that the coal dues might be prolonged for two years to enable the Council to "turn round."

Mr. FOSTER seconded the amendment.

Sir T. FARRER said it was quite obvious from the speeches of the mover and seconder of the amendment that what they intended was to defeat the motion; and, this being so, he opposed them *in toto*. The arguments that were urged in favour of the coal and wine duties were those which he had heard urged ever since Sir Robert Peel's attempts to remove taxes upon all articles of consumption. These taxes had been taken off with infinite benefit to the people; and he had no doubt that the repeal of the duties in question would be followed by equal benefit to the consumers in London. Mr. George Livesey, the Chairman of the South Metropolitan Gas Company, had informed them that his Company had already reduced the price of gas by 2d. per 1000 cubic feet; and they had done this, as to 1d. of it, in consequence of the abolition of the coal duties. They were not putting one farthing of the gain into the pockets of the shareholders; they were giving it all, and more than all, to the consumers. Other companies were doing the same. If these duties were levied for improving the port of London, there would be a great deal more to be said for them. There had been an omission of all notice of the 4d. per ton which went to the City. Were the members of the Council who represented the rest of London to consent for one, two, or three years to the City levying a coal due of 4d. per ton on the whole area under the jurisdiction of the Council? A portion of the money was to be returned to the outside area; but it would be given back in a way that would confuse the finances of those parishes.

Mr. FIRTH remarked that it might facilitate the discussion if he pointed out exactly what effect the coal duties had upon the rates. As a matter of fact, the duties were at present regarded as having come to an end. The portion that the Metropolitan Board of Works had was 9d. In 1888 this was estimated to produce £325,000. Under the Act of 1868 no duties could be collected after July, 1888, and paid to the Board of Works; but inasmuch as the duties were always paid three months after collection, they did receive last October the duties up to June. The loss of the coal dues for the last quarter represented £75,000; and this, deducted from the total estimated produce, left a balance of loss, to be charged on this year's rate, of £250,000. How did the loss stand as between the advantage that they obtained under the Local Government Act and the loss of the actual dues?

They stood to lose about £90,000 a year. As every penny of taxation would produce £131,000, to meet their loss rather less than a ¾d. rate would be sufficient.

Mr. M'Farlane very much doubted the wisdom of the Council extinguishing the duties at least for a year.

Sir J. Lubbock said, in explanation of the vote he was about to give, that in agreeing to the reference of the question he did not intend to vote for the renewal of the dues. The Deputy-Chairman (Mr. Firth) had said that, allowing for the subvention from Government, the difference would amount to a rate of ¾d. in the pound. But they would have the subvention in any case. The difference really amounted to 3d.; and the question was whether they should raise this amount by the dues or by a rate. This was a matter of the greatest importance; and he thought it would be prudent to refer it in the first instance to a Committee.

After some further discussion, the Council divided, and the amendment was lost by a majority of 28; the result being received with cheers. The motion was subsequently put, and carried by a majority of 42.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The report of the Directors of this Company, which will be presented to the proprietors at their half-yearly meeting next Friday, states that the general working of the Company in the six months ending Dec. 31 last was satisfactory. There was an increase of nearly 4 per cent. in the quantity of gas sold, as compared with the corresponding period of 1887; the prices of residuals were better; and the cost of coal delivered into the stores was lower. As already announced, the price of gas is to be reduced to 2s. 7d. per 1000 cubic feet from the date of the present quarter's accounts. The Directors recommend dividends at the rates of 6 per cent. per annum on the preference stock, 7 per cent. per annum on the ordinary 7 per cent. stock and shares, and 10 per cent. per annum on the 10 per cent. stock, less income-tax. The accounts accompanying the report show that the total gas-rental in the half year was £48,580; the meter and stove rental, £997; residuals produced £16,397; and rents, £60—total, £66,034. There was expended in the manufacture of gas, £41,633 (£25,550 being for coals); in its distribution, £3187; the lighting and repair of the public lamps cost £889; rents, rates, and taxes came to £1904; the management expenses were £3058; and miscellaneous items made up a total of £51,174. There was consequently a balance of about £14,860 to go to the profit and loss account, the total of which is £37,265. Deducting the June dividends and the income-tax—together £13,626—there is left a balance of £23,639 available for division. The quantity of coal and cannel carbonized in the latter half of last year was 38,112 tons; the gas produced being 381,186,000 cubic feet. Of the entire bulk of gas made and in store, 382,887,000 feet—357,110,000 feet were accounted for, and 1,638,000 feet were in store at the close of the year. The residuals produced were: Coke, 457,344 cwt.; breeze, 48,195 bushels; tar, 405,346 gallons; ammoniacal liquor, 762,240 gallons. The Company work up their liquor; and 285 tons of sulphate were produced in the six months covered by the report. Under the supervision of the Company's Engineer and Manager (Mr. C. Gandon, M. Inst. C.E.), the works were improved in several details at a cost of £1061; extension of mains, additional meters, and stoves making up a total of £2145 expended on capital account in the half year, and a grand total of £335,961 out of the £364,310 raised.

PROVINCIAL GAS AND WATER COMPANIES.

In the following paragraphs we give some particulars of the working of the various Companies mentioned during the periods stated:—

The thirtieth ordinary general meeting of the Eckington and Mosborough Gas Company, Limited, was held on Wednesday last—Mr. F. Barber presiding. The Directors' report for the past year showed a profit of £849. Dividends were recommended of 8 per cent. on the additional shares, free of income-tax. This would absorb £620, and leave a balance of £229 to be carried forward. The works, which are under the management of Mr. W. Hughes, have been maintained in a thoroughly efficient condition out of revenue. The report was adopted. The Chairman remarked that the management had been highly satisfactory; and he compared the past year with 1883, showing that 3500 cubic feet more gas per ton of coal carbonized were sold in the former than in the latter year.

The half-yearly general meeting of the Harrogate Gas Company was held on the 28th ult.—Mr. C. Allanson in the chair. In moving the adoption of the report, the Chairman remarked that the price of gas was reduced 3d. per 1000 cubic feet on Jan. 1, 1888; and as there had been an increase of 8¼ per cent. in the sales during the past year, the Directors had decided to make a similar reduction on the 1st of April next. This would make the net price 3s. 2d. to 2s. 8d., according to consumption. These reductions were equivalent to a gift of something like £1000 per annum to the consumers. The receipts had been about £500 more than in the previous year, on account of the greater consumption of gas, especially in stoves. But there had been increased expenditure to a like amount, owing to an additional outlay on coals and for renewals. The profit had not been sufficient to pay the statutory dividends; but the Directors had recommended them, although this had necessitated a draft upon the floating balance. They hoped, however, that the results of the current year's working would be such as to justify their policy. The report was adopted; and dividends at the rates of 15 per cent. per annum on the "A" stock, 11½ per cent. per annum on the "B" stock, and 10½ per cent. per annum on the "C" stock, less income-tax, were declared.

The Directors of the Hastings Gas Company in their report, presented at the half-yearly meeting of the shareholders last Thursday, stated that owing to the extreme mildness of the weather during the last months of the year and dulness of trade, the gas consumption did not increase in so great a ratio as in the corresponding half year of 1887. This, coupled with the reduction in price, caused a diminution in the gas rental, which, however, had been more than recouped by economies in the manufacture and the increased value of residuals. The accounts showed a profit balance of £9583 for the six months, which, with the balance brought forward from last half year, amounted to the sum of £25,603. The report was adopted; and it was agreed to pay a dividend at the rate of 11½ per cent. per annum on the £25 shares, and at the rate of 8¼ per cent. per annum on the £20 shares.

The Directors of the Lewes Gas Company had the gratification of recommending to the shareholders at their half-yearly meeting last Wednesday that the maximum dividend of 5 per cent. should be declared; the dividend having been less than this during the past few years. The revenue account showed a profit for the six months of £1454. After providing for interest on mortgages, the balance of net revenue was £1787.

The annual meeting of the Redcar Gas Company took place last Saturday week, Mr. J. Rutherford (Chairman) presiding. The report of the Directors stated that the receipts for the past year were £5253; the payments, £2978, including mortgage charges. A credit balance of £2492 remained as profit on the year's transactions. An interim dividend of 2½ per cent. had absorbed £850; and it was recommended and agreed that a further dividend of 4 per cent. should be paid, which would require £1360. The gas consumed by private persons for the year was 19,621,300 cubic feet; by cooking-stoves, 1,256,600 cubic feet; and for public lighting, 1,979,800 cubic feet. Notwithstanding the agitation last year, and the reduction of 6d. per 1000 feet in price, the loss sustained was only about £30; and the consumption had come within 50,000 cubic feet of that of the preceding year. It was agreed to abolish the charge for the use of cooking-stoves.

The report which the Directors of the Southend Gas Company will present to the shareholders at their annual general meeting on the 20th inst. states that, notwithstanding the reduction in the price of gas from 4s. 7d. to 4s. 5d., which came into operation on the 1st of July last, the gas-rental shows an increase during the past year. The balance available for division is £1108, from which the Directors recommend the payment of the statutory dividends. Having already paid an interim dividend amounting to £680, they now suggest the payment of £970, which will complete the yearly maximum dividends, and leave £138 to be carried forward. During the past year additional retort-benches were erected, in order to meet the probable increased demand for gas. This work was carried out to the entire satisfaction of the Directors by the Company's Engineer (Mr. F. Clark), who reports that the works and plant have been thoroughly maintained, and are in good repair and working order.

The accounts presented by the Directors of the Trowbridge Water Company at the recent annual meeting of shareholders allowed of the payment of a dividend for the nine months ending Dec. 31 last at the rate of 4¾ per cent. per annum. Since the previous meeting, the contract entered into with the Westbury Rural Sanitary Authority, for the supply of the villages of Hawkeridge and Heywood has been completed, and the necessary extension of the Company's mains made. The Manager (Mr. W. W. Gray) reported that the total number of premises supplied up to the end of the year was 3541, of which 157 were served through meter. The condition of the works was satisfactory. The above-named dividend was declared.

LEEDS CORPORATION GAS SUPPLY.

Mr. Lever and the Coal Contracts.—The Quality of the Gas.

A Special Meeting of the Leeds Town Council was held last Wednesday—the Mayor (Alderman Ward) presiding—to consider the minutes of the proceedings of the Gas Committee in regard to the charges brought by Mr. Ellis Lever in reference to the coal contracts.

Mr. Gilston (the Chairman of the Gas Committee), in moving the approval of the proceedings of the Committee, said the Council were aware that there had been considerable correspondence in the newspapers and a great deal of talk in the town about a resolution passed by the Committee instructing the Town Clerk not to answer any more letters from Mr. Ellis Lever; and it had been said by people whom he supposed knew no better (because he would not attribute it to any worse motive), that the Committee dare not face Mr. Lever and the charges he was prepared to make. He (Mr. Gilston) was glad to say that the Committee were not afraid of Mr. Ellis Lever, nor a dozen Ellis Levers, in any matters that came under their cognizance, or were under their control. The question arose as to why they authorized Sir George Morrison not to answer any more letters. Mr. Lever had not always been fair in his communications and correspondence with the Committee; and they were led to suppose that he was not treating them in a way that they had a right to expect. From the beginning Mr. Lever had insinuated and made statements of a kind that he was not always able to substantiate when proof was required. Mr. Gilston then proceeded to allude to the trucks of coal which were placed at Mr. Ellis Lever's disposal, and to the three samples he selected; remarking that Mr. Lever had not been able on that occasion to prove the charges he had made. The charges still stood; and Mr. Lever had not withdrawn them in the interests of the individuals concerned. This, he thought, was sufficient to warrant the Committee in ceasing to continue correspondence with Mr. Lever. The Committee had more to do than really to make gas and send it to the ratepayers. They had then under their control not fewer than 1000 hands. He believed they were served by a staff of honest and capable men; and until he had proof to the contrary, he would continue to look upon them as honest and honourable servants. Mr. Lever had been saying they were losing £17,000 a year by their gas undertaking. He (Mr. Gilston) need not tell them that there was no truth in this. They had not made so much profit during the past five years as had been realized in former years; but that the ratepayers had lost a single penny he denied *in toto*. In 1884 they were receiving 46s. a ton for tar, and they made from 14,000 to 15,000 tons a year; but during the greater part of the past five years, they had been only receiving 11s. a ton. For 10,000 gallons of ammoniacal liquor they used to get 99s., and now they were receiving 34s. for 10,000 gallons. They had obtained £158,000 less during the last five years for ammonia and tar than they would have done if these articles had remained at the prices at which they were in 1884. Now, this £158,000 had to be made up somehow or other; and how were they to make it up? By economy in working and by increased consumption of gas. He was glad to say that whereas in one year they lost as much as £46,000 on that score alone, at the end of last June they brought this sum down to a deficit of £5000; and he had no hesitation in saying that at the end of the next financial year there would be a large surplus in favour of the undertaking. But when he spoke of loss, what did he mean? Parliament had determined that the ratepayers should be amply protected, and that 1 per cent. of the whole of the undertaking should be laid aside to the credit of the ratepayers as a sinking fund; and since the gas-works came into the hands of the Corporation, he might say that there was a fund accumulated of not less than £180,000 that stood to the credit of the ratepayers out of the profits of the undertaking. During the five years he was speaking of, they had paid into that fund £43,745, and they had paid in the reduction of the lamp-rate £25,627 6s. 5d.; making a total taken out of the undertaking of £69,372 17s. 2d. during the past five years. The deficit they brought forward was £32,769 8s. 4d., which left to the credit of the ratepayers £36,603 8s. 10d. They had paid to the credit of the ratepayers during the last five years an average of £9150 17s. 2d. a year. During that time the sulphur impurities had been reduced; and the illuminating power of the gas had been largely increased. In the six months ending the 31st of December last, the average illuminating power of the gas was 19¼ candles; and this average was for 252 tests made by Mr. Buckley, not at the gas-works, but at five different points in the borough. They had also produced more gas from every ton of coal carbonized during that time than formerly.

The Town Clerk then read the following correspondence, which has not previously been published:—

Town Hall, Leeds, Jan. 4, 1889.

Ellis Lever, Esq., Culcheth Hall, Bowdon.

Dear Sir,—I have delayed acknowledging the receipt of your letter of the 29th of December until after the meeting of the Town Council of Leeds. I may now say that the minutes of the Gas Committee, which embraced the report of the Sub-Gas Committee, of which I furnished you with a copy, were confirmed by the Council without a dissentient vote. There does not appear to be anything in your letter of the 29th of December calling for answer or observation. You will

remember perfectly well that when you came here in October you were allowed a "free hand" in your selection of whatever coal you thought proper for the purpose of a rigorous test being made. You selected in my presence and in the presence of others, at the coal staithes, the waggons, the contents of which you wished to be tested, and expressed yourself then as satisfied that your contentions would be borne out by the tests. The statements referred to in your letter of the 29th were, I note, made by people in the years 1874 and 1875; and it is not suggested on our part that the parties then making the statements were not competent witnesses, or that the evidence at that time might not have been perfectly truthful. But such statements as those obviously cannot rebut the impregnable evidence furnished in November, 1888, by your own very capable Analyst, Mr. Paterson, of Warrington, and confirmed by the testimony of the Borough Analyst of Leeds, so well known here for his accuracy.

(Signed) GEORGE W. MORRISON, Town Clerk.

Bowdon, near Manchester, Jan. 8, 1889.

The Town Clerk, Leeds.

Dear Sir,—Your letter of the 4th inst. was forwarded to me at Colwyn Bay. You inform me that the minutes of the Gas Committee, which embraced the report of the Sub-Gas Committee, were confirmed by the Council without a dissentient vote; but it is left for me to ascertain from another source that when these minutes were confirmed there were present in the Council Chamber only twenty-six members, of whom twenty were members of the Gas Committee. This state of affairs is evidence of the indifference of the Council generally as to the working of what, in the absence of that indifference, might be made a highly profitable and successful business. If the Leeds gas undertaking were a private concern, I wonder how long it would keep out of the bankruptcy court. I am informed that the loss last year but one was £17,000! My letter of the 29th ult. does, in the opinion of many thoughtful people, demand a reply; but it may not be convenient or possible for the Committee to give a satisfactory answer. Mr. Gilston, as you know, did all in his power to thwart my inquiries at the Town Hall, on the 20th of October; and I saw little of him after that date. My telegram to the Mayor from Abergele on the 1st of November, which the Committee thought fit to suppress, distinctly says: "I am prepared to vindicate my statements that the cannel contains hub, slack, and pyrites. I will also undertake to bring Mr. James Paterson, F.G.S., to examine the cannel, hub, and slack, to report upon it, and make independent commercial analysis." That telegram should convince even the most sceptical that my purpose was to have an independent and reliable test; but in this I was defeated. I have said before that Mr. Paterson declared, both to me and to your Committee, that he could not possibly make a thorough and indisputable test of the materials selected in less than three or four days. How, then, can a test occupying only as many hours be satisfactory and "impregnable?" You are not correct in saying that the tests were made by Mr. Paterson and confirmed by the Borough Analyst of Leeds. In this you have probably been misled by the Sub-Committee. In anything I have said or done in connection with your Gas Department, I have been actuated by a desire to inform the Gas Committee, and to benefit the ratepayers. In all cases where I have endeavoured to do this, I have met with opposition and abuse; but I hoped for better things at Leeds. The evidence in my possession, to which I have before referred, is being constantly added to; and you may probably hear from me again. (Signed) ELLIS LEVER.

Some telegrams followed; one being to the Town Clerk, on the 14th of January, in these terms: "Editors *Leeds Mercury*, in Saturday's issue, assert that I may be quite certain the Corporation would see that all reasonable facilities were afforded me of proving my statements. That is all I have asked in a friendly spirit, and with no personal or interested motive, but solely on public grounds."

Mr. WILLEY seconded the motion. He remarked that no one would deny that Mr. Lever's allegations about certain deliveries of coal were found, on inquiry, to be utterly groundless; and, in his opinion, every opportunity had been given by the Committee to Mr. Lever to make good his case in these particular instances. But Mr. Lever brought charges of a more sweeping character, to the effect that the Gas Committee of the Leeds Corporation were receiving large quantities of coal which was inferior to the quality contracted for. He (Mr. Willey) was bound to say that this general charge had been fully proved by returns which had been placed before the Committee; and in his judgment a great deal of credit was due to Mr. Lever in connection with this important matter. He believed it was his statement which induced the Committee to consider the question of their coal supply.

Mr. GILSTON rose to a point of order. The Committee were, he said, investigating the matter, and had not brought up their report.

The MAYOR said the question was under consideration; but Mr. Willey was using it as an argument in support of his statement.

Mr. WILLEY remarked that the consideration of these coal tests was done with by the Committee. Mr. Lever had made a statement that the ratepayers were losing thousands of pounds per annum by receiving coal which was not of the quality contracted for. Returns were ordered to be prepared of their coal supplies for the five years ending June, 1888. These returns had been prepared by the Gas Secretary (Mr. Lupton); and they set out all the contracts in that period, and showed the average percentage of inferiority. In the year 1884, tenders were accepted from 24 contractors for the supply of 194,000 tons of coal. Out of these, 15 contractors supplied coal inferior in quality, amounting to 154,000 tons—that was three-fourths of the consumption in the year—resulting in a loss to the Corporation of £4801 5s. 8d. In 1885, tenders were accepted from 18 contractors for the supply of 166,000 tons of coal. Of these, 17 supplied coal inferior in quality, amounting to 130,000 tons—again three-fourths of the consumption—entailing a loss of £4657 11s. 6d. In 1886, tenders were accepted from 19 contractors for the supply of 194,600 tons. Out of these, 8 supplied coal inferior in quality, amounting to 71,000 tons; resulting in a loss of £1461 4s. 5d. In 1887, tenders were accepted from 24 contractors for the supply of 264,000 tons of coal. Out of these, 10 supplied coal inferior in quality, amounting to 102,000 tons; resulting in a loss of £1811 11s. 6d. In 1888, tenders were accepted from 25 contractors for the supply of 204,600 tons. Out of these, 14 supplied coal inferior in quality, amounting to 112,000 tons; resulting in a loss of £2012 2s. 6d. The total loss on the five years was £14,743 15s. 7d., or a yearly average of £2948 15s. 1d. He thought these figures were very startling and suggestive. The Council would naturally ask, When these figures were placed before the Committee, what excuse was made? The defence was somewhat peculiar. One excuse put forward was that although this coal was supplied inferior in quality to what it ought to have been, the commercial value of the coal was very much higher than the price paid for it, and therefore they were really making a profit. Another excuse was that although these deliveries of coal were inferior, others were superior; and, taking the thing all round, one balanced the other. He thought the Committee should have a clause in their agreements to enable them to stop a proportion of the amount of the contract, according to the inferiority of the coal supplied.

Alderman SPARE expressed surprise at hearing that the illuminating power of the gas was 19¼ candles. The quality had never been up to the standard required by the Magistrates since June, 1888. As compared with 1884, the gas for the last six months had been not less than a candle below that of the date he had named. The average for the past six months was 18·75 candles. There was a vast amount of trickery going on in the gas-works of the borough; for by means of a pipe they could turn on gas of better quality when it was going to be tested. He undertook to prove numbers of things by which in their gas-works they were losing money. He quoted figures to show that there was leakage equal to about 3d. per ton of coal used in the manufacture of gas in Leeds, as against less than 2d. in other large towns; representing a loss of not less than £10,000 every year. Surely, he said, this was a matter that ought to be looked into.

Mr. SLATER expressed his admiration for the able manner in which Mr. Willey had brought this matter before the Council. It was no doubt true that Mr. Lever had failed in his selection of coal for testing purposes; but if, instead of being cut off in the discourteous manner which had come to their knowledge, he had been allowed to make another test, he would probably have been able to satisfy even the members of the Gas Committee and their Chairman that they had been receiving coal of the character he represented. The town owed it to Mr. Lever that they had discovered the state of things which existed in the management of the gas-works. He thought the best remedy against future mismanagement would be to appoint a Gas Engineer.

Alderman Sir E. GAUNT wished that Mr. Gilston and others who took different views on this question would meet together and decide the matter; Mr. Gilston asserting that the gas was up to a certain standard, while Alderman Spark was equally emphatic in saying that it was not. For himself, he believed that Alderman Spark was correct. He suggested that a small Committee should be appointed, either inside or outside the Council, to consider the question.

Mr. GILSTON, in reply, said the gas question was one that would be always with them if they had all the experts in the kingdom. If they were making contracts on certain terms, they had inherited these terms from those who preceded them. The question brought forward by Mr. Willey had been considered by a Sub-Committee, who had reported to the Gas Committee. The Committee had discussed the report up to a certain point, and its further consideration was referred to another meeting, which had not yet taken place. In the absence of that further consideration, it was hardly fit that the matter should have been laid before the Council. In 1886-7 they had 785 tons of coal more than they paid for, on the ground of these tests. In 1887-8, they had 1405 tons more. But what did it all mean? It meant that these were the results of a laboratory test of the coal. What was done at Birmingham, Manchester, and Liverpool they did in Leeds. If coal was sent that was less valuable than it ought to be, they sent it back; and they had returned as much as 150 tons. If a man sent inferior coal after being warned, they stopped him. If there was a better way, the Committee would be glad to adopt it. He pointed out errors in Mr. Willey's figures. That gentleman gave the result of the loss upon 264,000 tons of coal in 1887. But in that year they only used 205,000 tons; so that there was 55,000 tons of coal taken into the calculation that was never used at all. Replying to Alderman Spark, he said he had before him the returns by Mr. Buckley of the illuminating power of the gas for the six months ending the 31st of December last, and these returns were corrected, not by himself, but by Mr. Fairley, who was an expert. During the whole of that six months the gas had never in any one week averaged less than 19 candles except once, when it was 18·98 candles. Alderman Spark thought he had made a point when he spoke of trickery at the gas-works, and how the public were being deceived. He was amazed that Alderman Spark should have said anything of the kind, because he knew it did not affect a single test that Mr. Buckley could make. The tests were made at stations out of the works altogether, and had not been conducted at the works, where this "tap" was alleged to be. The Leeds gas undertaking would bear favourable comparison with any other in the country. He had no fear of a commission or of experts; but if they were to have experts, let them be men whose opinion would be worth receiving and handing round to the Corporation for their guidance.

The motion was then agreed to.

SALFORD CORPORATION GAS SUPPLY.

THE DEPRECIATION FUND—THE INCREASE IN THE MANAGER'S SALARY.

At the Meeting of the Salford Town Council last Wednesday—the MAYOR (Alderman Dickins) presiding—the Gas Committee reported that they had instructed the Borough Treasurer and Gas Engineer to ascertain the amounts which have been from time to time charged in error to the revenue account; and that the sums so ascertained be charged to the depreciation fund, and the sum transferred to the profit and loss account, it being understood that the amount so transferred does not exceed £60,000. Alderman Husband reported that complaints had been made at the last meeting of the School Board of the quality of the gas supplied to the board schools, and a resolution was passed that the Engineer ascertain the particulars of the complaint referred to, and investigate it with a view to applying a remedy. A resolution was passed referring to a Sub-Committee the subject of testing the gas, with a view to ascertain the influence of the burners on the illuminating power. A letter was read to the Council from the Clerk to the Barton Local Board, representing the gas consumers of the Barton and Eccles district, with reference to the proposed distribution amongst the three districts comprised in the borough of the £60,000 to be transferred from the depreciation fund. The Board objected that such transfer and distribution was in direct contravention of the Local Acts controlling the gas supply, and asked the Corporation to receive a deputation, an interview with whom might, the writer added, "obviate the necessity and unpleasantness of proceedings which they (the Board) might otherwise be advised to take." Mr. Jackson objected to the transfer of the money. Alderman Makinson asked the grounds of objection by the Barton Local Board—what *locus standi* they had for objecting. The Mayor replied as consumers of gas. He added that as Mr. Jackson had objected to the minutes, the matter would have to be discussed at the next meeting of the Council.

A lively protest is still maintained against the action of the Council in increasing the salary of Mr. Shoubridge, the Gas Engineer and Manager. A public meeting called for the purpose of considering the matter was held at Pendleton yesterday evening week, at which the following resolution was passed:—"That this meeting emphatically protests against the resolution of the Council to increase the Gas Manager's salary, believing the same to be premature, and calls upon the members for the Pendleton district to take the earliest opportunity of obtaining the rescindment of the said resolution." One resolution condemned the action of the Alderman for the district in declining to call a meeting to consider such a resolution. Mr. Rycroft, a member of the Corporation, who was conspicuous in his opposition to the old Gas Committee, has thought it necessary to defend, in a long letter which has been published, his action with reference to the increase of Mr. Shoubridge's salary. He says the proposal was brought forward at the time it was submitted because of a Standing Order of the Council which requires that all questions of advances shall be dealt with in February. Those who voted against the advance admitted that Mr. Shoubridge had claims against the Corporation; and the only plea raised was that the proposal was premature, and the amendment asked that it should be postponed until the end of the financial year, which is the 31st of March. He adds: "In forming my judgment, I had to consider whether or not the Engineer was worth £600 per annum; and I deliberately came to the conclusion that he was. . . . It is a very easy matter for persons who know little or nothing of the circumstances, to rail at the Gas Committee. Even with the disadvantage of the contracts entered into by the former Engineer, Mr. Shoubridge has increased the profits by £13,000; and we may look forward to further profits and a further substantial reduction in the price of gas. The increased salary is less by £200 than the sum paid to 'Hunter.'"

BURNLEY CORPORATION GAS SUPPLY.

APPOINTMENT OF A NEW MANAGER.—ADOPTION OF THE CLAUS PROCESS.

At the Meeting of the Burnley Town Council last Wednesday—the MAYOR (Ald. Greenwood) presiding, the Gas Committee reported that they had resolved to make sulphur from the waste gases resulting from the manufacture of sulphate of ammonia, and they asked the Council to sanction the purchase of a Claus sulphur plant from Messrs. C. and W. Walker, at a cost of £330. The failure of the contractors for tar to comply with the conditions of their contract was reported; and it was resolved to advertise for new tenders. The Committee also passed a resolution expressing their deep sympathy with Mrs. Leather and Mr. J. P. Leather at the loss they have sustained in the sudden and unexpected death of the late Mr. S. P. Leather, and placing upon record their high appreciation of the great services deceased rendered to the Corporation as Gas Manager for a period of 26 years. They recommended the Council to appoint Mr. John Petty Leather as Manager in succession to his father.

Mr. COLLINGE, in moving the acceptance of the Committee's resolutions, said they expected to realize a profit of £100 a year by the manufacture of sulphate of ammonia, so that the Claus plant would pay for itself in about three years.

Alderman SUTCLIFFE inquired if the conditions were any more favourable now than when the manufacture of sulphate was abandoned some years ago as being unprofitable, and whether this would not compromise the selling of the tar and ammonia together.

Mr. COLLINGE replied that the manufacture of sulphate was quite another matter. He did not think the contract for tar and ammonia would be affected at all. The Committee recommended the appointment of Mr. John P. Leather as Gas Manager, in place of his father, whose death they all regretted. Mr. John Leather had had the practical management of the works for some years, owing to his father's failing health, and was thoroughly acquainted with all the details of the undertaking. This, coupled with his practical experience, would enable him, in the opinion of the Committee, to carry out all their requirements.

The MAYOR, who had been associated with the late Gas Manager for about 10 years, stated that during the 27 years Mr. Leather had been at the works, the consumption of gas had increased about sixfold, while the population had risen about threefold. Mr. Leather in dealing with this increase, and also the general management of the works, had shown himself to be a very able and faithful servant.

The resolution was adopted.

HALIFAX CORPORATION GAS SUPPLY.

THREATENED STRIKE AT THE WORKS—THE PRICE OF GAS.

The appointment of Mr. J. Hoggard, who has been for the past four years foreman at the Batley Gas-Works, to the position of Superintendent of the Halifax Corporation Gas-Works (as recently announced in the JOURNAL) has created a considerable amount of dissatisfaction among the old *employés;* and it is stated that a strike is threatened among the men. The foremen of the carbonizing, purifying, and erecting departments have sent in to the Gas Committee notices to leave their employ as a protest against what they designate the "dubious way" in which the selection of Superintendent has been "sprung" upon them. They point out in their joint communication to the Gas Committee, that it is very poor encouragement for them to interest themselves in the works when they are ignored and precluded from any possible chance of advancement when a situation offers itself; and then go on to remind the Committee that, when the late Manager visited the Antipodes, he gave them every assurance, before they would sanction his leave, that he had every confidence in the ability of his staff of foremen to carry on the works in his absence. The men think, if the Committee would take the trouble to examine the books, and see the quantity and quality of gas made during the time of their supervision, it would be found to compare favourably, if not to exceed anything for a corresponding period for any number of years. The late Manager congratulated them on their achievements; and they were under the impression they had given every satisfaction to the section of the Committee deputed to visit the works. They believed they had won the confidence of the Committee, and were not aware that they had done anything to justify the withdrawal of that confidence. Hence their grievance and protest. One of the signatories, the foreman fitter, was discharged on Tuesday last, as was also one of the workmen in the retort-house. The other three foremen left on Saturday, when their week's notice expired. The foremen have the sympathy of the workmen, all of whom—coalers, stokers, labourers, and others—gave a week's notice last Tuesday, which expires at 6 a.m. to-day (Tuesday). Meanwhile, the Committee have been arranging to fill the places of the men, who, on their side, are endeavouring to induce others to abstain from applying for work. Policemen were posted at the works on Friday and Saturday to prevent interference with those whom the Manager (Mr. T. Holgate) was seeking to engage.

Some reference was made to the cause of the dispute at the Town Council meeting last Wednesday. The Gas Committee reported, amongst other things, the appointment of Mr. Hoggard; and the Mayor (Alderman J. Booth), in proposing the adoption of the minutes, said he had received a letter from Alderman Longbottom, asking a few questions which he desired to answer. The first question was, "Will you please explain this evening, when you move the minutes of the Gas Committee, the reason for employing a foreman at £2 10s. per week?" The reason was that the Committee thought it desirable that such a man should be employed; and they unanimously agreed to it. Secondly, "Will you please state how it is the illuminating power of the gas is still so much below what the Committee assured us it should be?" Well, the illuminating power of the gas had been gradually getting better. On Feb. 27 it was 17·66 candles; March 2, 17·89; March 6, 17·97; and in the last three or four days, he believed, it had been 18·4. Then there was something said about the purification of the gas—about the sulphur. The gas was quite as pure as it had been known for a long time. Alderman Longbottom said he asked also how it was that a stranger was appointed at £2 10s. a week; and whether they had not a servant of their own who could have been placed in the position? The Mayor replied that he did not think it was a very proper question to put; and he did not consider it would be right to answer it. Mr. Binns seconded the adoption of the minutes, and said the return as to the gas was not an official report from the gas-works, but from Mr. Ackroyd, the Borough Analyst. The minutes were passed.

Telegraphing last night, our Halifax Correspondent said: "The Mayor and the Gas Committee met the *employés* this afternoon, and the men demanded the reinstatement of four foremen of departments, and the dismissal of the new general foreman. This demand was unanimously refused by the Committee, with the result that the whole of the men whose notices expire to-night at once left the place in a body. They were told to apply at the Town Hall to-morrow forenoon for their wages, and the works were closed. The result threatens to be rather serious, as there is only gas in store representing eight hours' consumption. The Committee offered to reinstate the foremen, but refused to discharge the Superintendent. It is expected that 40 new men will be ready to start work to-night."

BURTON-ON-TRENT CORPORATION GAS SUPPLY.

THE DUTIES AND REMUNERATION OF THE MANAGER.

At the Meeting of the Burton-on-Trent Town Council last Wednesday—the MAYOR (Mr. C. Harrison) presiding—the Gas Committee's report embodied a recommendation that the salary of the Gas Manager, Mr. F. L. Ramsden, should be increased by £100, and this gave rise to a discussion, in which some interesting particulars respecting the undertaking were introduced.

Alderman LOWE, in moving the adoption of the report, observed that it had been said in the town that this was hardly the time to increase salaries, seeing the state of trade in Burton; and while he sympathized with those who were suffering from bad trade, he thought he should be able, on behalf of the Committee, to justify the recommendation. There had not been the slightest attempt to rush the matter through the Committee or the Council. The application for an increase of salary was received from Mr. Ramsden in October, 1887. It was considered; and they decided to put it off till after the November election of councillors, as it was regarded as only right and fair that the new members of the Council should have an opportunity of considering the matter. It was brought on immediately after the election; and again postponed. Soon afterwards the Gas Committee were prepared to make a recommendation on the subject. But at that particular time the Salaries Committee was appointed; and the Gas Committee were advised by the Town Clerk that it would hardly be wise to make any recommendation while the latter were considering their report. That Committee only presented their report last month; and thus Mr. Ramsden had been put off for nearly eighteen months, owing to the circumstances he had mentioned. The Manager's salary at the present time was £350; but in the year 1872 the then Manager (Mr. J. Mudie) received £400. At that period the make of gas was 66 million feet per annum; now it was 200 millions. In 1884 Mr. Mudie's salary was increased to £450; and this was the amount which the Committee advised should be given to Mr. Ramsden. In 1886, owing to Mr. Mudie's failing health, the Council consented to provide for him a house away from the works, and also agreed that he should have the rent of the house and certain expenses over and above his £450. Then the make of gas was 170 million feet per annum; and it was now 200 million feet. Thus they would see there had been a great increase in the quantity of gas made, while additional responsibility had been thrust upon the Manager. The profits made were correspondingly favourable. During the first two years of Mr. Ramsden's management, the profits on the department were £1000 in excess of the two previous years, notwithstanding that during the same period the revenue was diminished by £1414 by the reduction on the sale of tar and ammoniacal liquor. Objection might be taken to the recommendation on the ground that £100 at one stroke was a large increase; but the Committee had a precedent in the case of Mr. Mudie, who, in 1872, received an increase such as that it was now sought to give Mr. Ramsden. The latter was a most able and successful Manager, and an Engineer of high order. They would remember that some time ago the Corporation decided to extend the gas-works at a cost of £40,000. On all previous occasions, with the exception of one, an Engineer had been requested to carry out the work. For the recent extensions, however, Mr. Ramsden prepared plans which were brought before the Committee, and referred to Alderman Canning and Mr. Stirk, who thought there were in them indications of great engineering skill. The Committee considered they would be acting wisely if they entrusted the work to Mr. Ramsden, although he was not engaged as Engineer; but previous to that decision being arrived at, they took the precaution of consulting the eminent Engineer, Mr. Woodall, and he made a report upon the plans and specifications of Mr. Ramsden. He approved of them with one or two trifling exceptions, and made this remark—"The tank will require much care in designing and building." That care had been exercised; and the work properly carried out. Mr. Ramsden had, in fact, made a first-rate job of it. It had been tested; and it answered admirably. In addition to all this, a large tank had been constructed which would hold double the quantity of that designed by Mr. Hawksley, and at less cost. The Council at its last meeting agreed to a recommendation for the construction of new purifiers at a cost of £5000. Works had already been carried out by the present Manager to the extent of £14,000, by which a saving of £600 or £700 had been effected; and a further saving of £250 in commission would result. The turnover on the gas-works was £30,000; and if they had an indifferent Manager, the results would certainly not be so favourable.

Alderman WRIGHT seconded the motion.

Mr. GRAHAM agreed with Alderman Lowe in all he had said in regard to Mr. Ramsden's abilities; but he should be compelled to vote against the recommendation of the Committee in its present form. On the gas-works a profit of £7900 was made last year on a turnover of £90,000.

Alderman LOWE: A profit of £9258.

Mr. GRAHAM said in the case of the Derby Gas-Works, a profit of £21,467 was made on a turnover of £34,066; therefore, if they were going to argue on those figures, the argument would not be particularly strong. Mr. Ramsden was the Corporation's Resident Manager and Engineer; and he (Mr. Graham) had always held that when a man was appointed, it should be clearly understood that he should be expected to carry out any works that might be required, and that the Council should resort to the additional security of having a Consulting Engineer to survey and supervise his plans and designs. They had the utmost confidence in Mr. Ramsden, and if he (Mr. Graham) could feel that the £450 was to be the ultimate amount of Mr. Ramsden's salary, as it was Mr. Mudie's, his mind with regard to the increase might be altered; but he could not shut his eyes to the fact that the Manager must feel that at his age he had a career before him. They must not forget that Mr. Ramsden was allowed a house, with expenses connected therewith, which was worth £50 a year, and he would be prepared to move that the Manager be given an honorarium of £100 for work which they felt he had done outside his ordinary duties, and an increase of salary of £50. This would not interfere with him making application for another increase at any future time.

Mr. RUGG emphatically protested against the recommendation, as he considered it meant an extravagant waste of the ratepayers' money. He had nothing to say against Mr. Ramsden's abilities.

After further discussion,

Alderman LOWE pointed out that the difference between those for and against was £150, as the increase would date from the time of the original application. They had no claim on Mr. Ramsden to do the extra work that had been referred to; he never undertook to do it. He was advertised for as Gas Manager. He had practically saved the town £1000. He certainly thought the Corporation should treat their officials as the latter treated them.

The resolution was then put; and it was carried by 19 votes to 8.

THE "Clamond Lighting Agency" is the title of a joint-stock undertaking lately registered with a capital of £1000, in £1 shares, for "the sale of illuminants, and working an agency for the Clamond light."

MR. DENNY LANE ON ELECTRIC LIGHTING.

The remarks made by Mr. Denny Lane at the recent meeting of the shareholders of the Cork Gas Consumers' Company (allusion to which was made in our "Electric Lighting Memoranda" last week) gave in a nutshell the present position of electric lighting; and, therefore, some extracts will, we think, prove of interest to our readers. Mr. Lane, it may be prefaced, had been requested by the Board to proceed to England and "post himself completely" as to the condition of electric lighting; and how thoroughly he fulfilled his mission, will be gathered from his statements. The observations which he had to make to the shareholders would, said Mr. Lane, form a very small portion of the amount of information that he had collected, particularly within the last six months, but really during the last ten years. It was a subject which had constantly engaged his attention; and happening to know something of the elements of the science for many years, of course he could in the same time learn more than a person previously unprepared for it. It was a good many years ago since he first told the shareholders that they need not be alarmed at the wonderful prophecies made of what was called "the light of the future," but which was at present like "the light of other days." As far as public lighting was concerned, it was actually so. He remembered, at the time of the Exhibition in Paris, the whole of the Avenue de l'Opèra was lighted with electric lights; and for that they paid as much, or rather more, than the Corporation of Cork paid for lighting the whole city. The Corporation of Paris—the richest Municipality in the world—found, to use a French phrase literally, "that the game was not worth the candle." The game not being worth the candle, they put out the candle; and it had been out for several years. He had visited Paris several times since; and last summer he was over there, and found there was not a single street lighted by electricity. There were public places lighted by it—one close to the Tuilleries had a few very fine arc lamps. They were a luxury; and he should say an expensive luxury, because he found in the *Journal Industriel* that the price charged for these lights was equivalent to £1 4s. per 1000 cubic feet for gas. There were several other public lights in Paris, in front of the Chamber of Deputies and at other places; but they were all extinguished now with the exception of one in front of the Opera House. London had been lighted by the electric light from Blackfriars Bridge to the foot of Ludgate Hill round to Cheapside, Cornhill, through King William Street to London Bridge, and part of Cannon Street. This was undertaken by the Siemens—the most responsible and best managed of any electric lighting company. After one year, they abandoned the contract, as they could not continue unless they obtained a higher price. It was then undertaken by the Brush Company, who were anxious to be advertised; and they continued it for a short time longer, and the lights were then extinguished. Then the Thames Embankment was lighted by Jablockoff candles; and these had been out for several years. Edison's Company tried the lighting of Holborn and the Viaduct with the same result—extinguished. Colchester was lighted with the electric light—and extinguished. Chesterfield was lighted—the light was extinguished. Liverpool had some public lights; and they were extinguished. At the present moment, as well as he could remember, there were but four towns which were lighted by the electric light. There were three in England and one in Ireland—Leamington, Barnet, Taunton, and Waterford. In Leamington it had been so unsatisfactory that the Corporation had notified the contractor to discontinue the light in the present year, or as soon as possible. In Barnet the light had frequently gone out altogether, because, on the principle of the system, if one went out the whole went out. There remained Taunton and Waterford. At Waterford the Corporation were only charged £22 per lamp for lights. He could show by the printed circulars inviting people to adopt the system, that these lights should cost them £30 each; and they were dealing generously with the Waterford Corporation, for advertising purposes, by giving them for £22 what cost them £30. At Leamington, for lamps nominally of the same power, they charged as much as £42 a year. Under these circumstances, it seemed strange, when the richest municipalities in the world—as those of London and Paris were—could not afford to pay for electric lighting, that there should be a movement in Cork among certain members of the Corporation to introduce electric lighting. He was not aware that Cork was so rich a city. In Waterford they had no city rates; the corporate property was so large. But he (Mr. Lane) had heard people whisper in Cork that the united rates of the city came to some 10s. or 11s. in the pound. Perhaps it was the desire to bring them up to 20s. in the pound. What induced these gentlemen to introduce that subject? The Corporation had no power to open the street for the purposes of electric lighting, as the Board of Trade would not permit them. Probably gentlemen were actuated by high motives of patriotism—motives of patriotism that would induce foreign contractors to come and take away the profits out of the pockets of Cork citizens. There was a very enlightened view taken of municipal interests when they tried to interfere with the largest ratepayers in Cork. Between city rates and poor rates, the Gas Company paid £2200 in Cork; and for every pound that was taken off the profits—they were valued on their profits—there would come out of the pockets of the Corporation and Poor Law Guardians, 10s. This showed an enlightened municipal idea. Then, of course, all sorts of charges were made. At the last meeting of the Corporation it was stated that the question was adjourned because a gentleman was there in a double capacity, and that no gas shareholder should ever be allowed to be elected a member of the Corporation; and their neighbour, Mr. Michael Murphy, was charged with having assisted in shelving the proposal because he was a gas shareholder. As a matter of fact Mr. Murphy had never held a single share in the Gas Company. At Leamington, he proceeded, where the charge was £42 a lamp, electric light had been in use for a year and a half; and comparing the consumption of gas there now with what it was before the introduction of the electric light, there was an increase of 3 per cent., instead of a falling off. The Chartered Company of London had in its district the largest amount of electric lighting; and notwithstanding this, he saw, by the Company's last report, that gas lighting had increased by £150,000. The Chairman of that Company, at the recent half-yearly meeting, referred to the Bond Street district, in which is situated the Grosvenor Gallery, which is lighted by electricity; and he took for comparison 325 gas consumers, some of whom used electric light also. The result was that the gas-rental for the place, which was formerly £7527, had increased to £7836, being an increase of £309, or 4 per cent. in the district. With regard to that district, the supply of the electric light if they charged by so much per hour, would be at the rate of 6s. 8d. per 1000 cubic feet for gas. He could undertake to show, and he was perfectly satisfied of it, that if they charged by the number of hours (as they did in most cases) the lights were burning, the prices would be double that of gas, because he saw lamps, nominally of 6-candle power, which gave a light of only 5 candles. At Charing Cross Station, where the electric light was in use, he (Mr. Lane) saw a man checking tickets by the aid of a gas-lamp; and he asked him why did he not do it by the electric light; and his answer was that he could not check one in a hundred by it. Besides that, the place was most dismally lighted. Similar complaints were made by the jewellers in Bond Street, who said they would pay any money, but could not get an efficient light by electricity. He believed, and he always said, that the electric light had its legitimate place. He considered there were many places where it could be economically and profitably used; and in some cases, perhaps, in preference to gas. There was no doubt progress had been made in electric lighting; but there were certain points in which they could not make any progress. The first was in the direction of a given amount of power converted into electricity; progress was absolutely barred, because they had already converted 95 per cent. of the power into electricity. Comparing that with the steam-engine, the best engine did not convert more than 10 per cent. of the energy of the fuel into power. The progress was marvellous; but it was utterly impossible to get more than 100 per cent.; and if they obtained 95 per cent., there could scarcely be any further progress. There had been little or no progress in the conversion of electricity into light; but there had been in the conveyance of it by carrying currents at high tension. It was proposed in London to carry the light at a pressure of 10,000 volts, varying to 2000; and they could understand how safe that would be when he told them that it was proposed at present in the State of New York to execute criminals by electricity at a tension of 700 volts—so that they proposed in London to carry more than twice the amount of electricity that was necessary to kill a man instantaneously! If the wires were carried underground, the leakage and the expense of insulation would be so great that they could only carry it at a low tension. Batteries were still made in the same way as on the first day when Sir Humphrey Davy saw the electric light from his big battery. Nothing could be discovered that could excel a copper wire for conducting power. He had seen them laid down in London; and the expense was enormous—from £2500 to £5000 or £6000 per mile. He did not think there would be any important economy in the laying of the wires; and there could be no improvement in production. There was nothing like coming to a practical test. As far as he knew, there was not a single electric lighting company paying a dividend, except one, which paid a dividend of between £200 and £300 a year; and a gentleman who wrote to him from England said he was not sure whether that was a real or a paper dividend. This £200 or £300 was the sole result of the millions—he said advisedly—millions spent on electric lighting in England. He had told them before that these Companies had paid scores of thousands of pounds for patents that were not worth the paper they were written on; and after the experience of several years, he would again repeat that. He would give them some examples of what the dividends on gas shares were. The smallest dividend on original shares in England was 10 per cent.; and they varied to 13½ per cent., and some paid more. He found that in the case of the Anglo-American Brush Electric Lighting Company's shares, £4 paid, the dividend was *nil*; same shares, fully paid, dividend *nil*; Swan United shares, £3 10s. paid, dividend *nil*; Maxim-Weston shares, quarter paid, dividend *nil*. There was the whole result of the millions of money that had been wasted on worthless matter; and yet they had certain electro-maniacs in Cork who thought they should introduce electric light into the city (laughter). Mr. Lane's remarks throughout were cordially received; and many of his statements caused much amusement.

THE PROPOSED TRIAL OF ELECTRIC LIGHTING AT CHELTENHAM.

The question of having a trial of electric lighting at Cheltenham has been for about twelve months under the consideration of a Committee of the Town Council, who have reported thereon from time to time. Their final report is now before the Council; and the subject was upon the business paper for discussion at their meeting yesterday. After reviewing the resolutions already passed on the subject (the Council having twice affirmed the desirability, subject to being satisfied as to cost, of introducing the electric light in the borough, and stated that it was the duty of the Corporation to undertake its introduction), the report goes on to say that the Committee have been in communication with two of the largest electric lighting companies in the world, and have obtained from them covering estimates at which they would themselves contract. The Committee come to the following conclusions:—That motive power, generating machinery, circuit, lamps, and other plant sufficient for 60 arc lamps of 1200-candle power each, and 2300 incandescent lamps of 16-candle power each, including £1800, the estimated cost of the site and buildings, can be put up for £11,900. This estimate is based on the circuit being partly underground and partly overhead. On the assumption that the whole of the arc lights will be alight on an average nine hours per night, and that the incandescent circuit has pressure on for 18 out of 24 hours—the incandescent lamps being supplied by meter, and alight on an average 1500 hours each per annum—the annual cost of the production of this light, including repairs, maintenance, depreciation, and interest and repayment of capital, will be from £3300 to £3700 per annum. Assuming that 2000 16-candle power incandescent lamps yield an income of about ¼d. per lamp per hour, and 20 arc lamps are let out at £15 per annum each, the Committee estimate that the cost of the 40 public arc lamps would be under £250 per annum. The number of lamps in this calculation is below the number which the plant is designed to supply; and as the demand for light increases, the income will increase accordingly, which will allow of a proportionate extension of the public lighting at no greater cost. The Committee estimate that 40 arc lamps would render unnecessary 180 of the existing gas-lamps, which, at the present reduced price per lamp, would cost about £450 per annum. A saving of £200 per annum would therefore be effected in the public lighting; while the power of the light would be many times greater. The Committee, having given an approximate estimate of the cost of the electric lighting proposed, ask to be allowed to proceed with the matter and procure tenders.

Harrow District Gas Company.—In the report of the Directors of this Company to be presented to the shareholders at their meeting on the 25th inst., they state that the balance of the profit and loss account is £1709, out of which they recommend dividends at the rates of 7½, 7, and 5¼ per cent. per annum on the various classes of capital. As already announced, a reduction of 3d. per 1000 cubic feet is to be made on the price of gas from the 25th inst.

Reductions in Price.—The Directors of the *East Ardsley Gas Company* have decided to reduce the price of gas to 3s. 9d. per 1000 cubic feet as from the 1st of July next. The present prices are 4s. and 4s. 2d., with a discount of 5 per cent.——Reference was made in the Journal last week to a public meeting held at Harwich to protest against the high price charged for gas by the *Harwich Gas Company*. It is now stated that the Directors have resolved to make a reduction of 9d. per 1000 cubic feet from the 1st prox., which will bring the price down to 4s. 3d. ——The Directors of the *Ilfracombe Gas Company* have reduced the price of gas to 3s. 9d. per 1000 cubic feet as from the commencement of the year.——The *Sittingbourne and District Gas Company* have reduced the price of their gas 3d. per 1000 cubic feet.——The Directors of the *Wandsworth and Putney Gas Company* have announced that the price of gas will be reduced to 2s. 6d. per 1000 cubic feet from Lady-day next.

INTERNATIONAL STANDARDS FOR THE ANALYSIS OF IRON AND STEEL.

At the last Meeting of the British Association, a Committee (consisting of Professor Roberts-Austen, Sir Frederick Abel, Professor Langley, Mr. E. Riley, Mr. G. J. Snelus, Mr. J. Spiller, Professor Tilden, and Mr. T. Turner) was appointed to consider the best method of establishing international standards for the analysis of iron and steel. It was proposed that the Committee should co-operate with other similar Committees in the more important iron-producing countries, in order to provide standard specimens of iron and steel, the chemical composition of which shall have been carefully determined. The specimens adopted as standards are to be entrusted to some recognized official authority—such as the Standards Department of the Board of Trade—to be used either for reference in the determination of the accuracy of any proposed method of analysis, or for controlling the results of analyses in any cases of importance which may from time to time arise. The Committee have drawn up the following preliminary suggestions:—

1. Professor J. W. Langley, of the University of Michigan, U.S.A., to be requested to superintend the production of the samples; that they be prepared and preserved in accordance with the directions to be furnished by the Committee; and that an equal portion of each sample be forwarded to the several Secretaries of the respective Committees in the United Kingdom, America, France, Germany, and Sweden.

2. The specimens which are eventually to be adopted as standards to be supplied to not more than seven representative chemists of repute in each of the countries above mentioned, who shall be requested to analyze the specimens by any method or methods they may prefer.

3. In the event of the analyses giving results which, in the opinion of the Committee, may be regarded as sufficiently concordant, the means of the analytical results of each of the several constituents to be adopted as representing the composition of the standards. The report on the analytical results not to be issued before the various analysts, to whom the samples have been submitted, shall have had an opportunity of examining it. The standards shall hereafter be distinguished only by letters or numbers.

4. The attention of the Committee to be for the present confined to four samples of steel, selected as containing as nearly as possible 1·3, 0·8, 0·4, and 0·15 per cent. of total carbon respectively. In addition to the determination of the amount of carbon present in each condition, the phosphorus, sulphur, silicon, manganese, and chromium also to be determined.

5. 150 kilos. of the samples selected for examination as standards to be prepared in all. This would give, after allowing sufficient for the required analyses, quite 5 kilos. of each standard for each of the five countries interested. Allowing say 10 grammes for each applicant who may desire to use the standards, this would permit of five hundred appeals to each of the four standards in each country, or at least 10,000 appeals in all.

6. The samples to be analyzed in the United Kingdom by W. Jenkins, Dowlais; Edward Riley, London; J. E. Stead, Middlesbrough; the Royal School of Mines; G. S. Packer, of the Steel Company of Scotland; and two others.

7. The metal of which the samples are to be produced to be cast in small ingots, special care being taken to prevent any irregularity of composition. After the removal of the outer skin, the metal to be cut by a blunt tool in the form of thin shavings, then crushed, sieved, and intimately mixed.

8. The samples thus prepared to be preserved in separate small quantities (say of 30 grammes each), which shall be hermetically sealed in glass tubes so as to prevent oxidation.

CRUDE LIQUID HYDROCARBONS AS HEATING AND LIGHTING AGENTS.

In the course of a lecture on the above subject, recently delivered by Mr. B. H. Thwaite, of Liverpool, before the Liverpool Polytechnic Society, he gave some interesting particulars, of which a record may be useful to our readers.

He commenced by dealing with the origin of petroleum; and expressed his concurrence in the theory of Lesquereaux that petroleum is the result of the decomposition of marine plants, as coal is the result of terrestrial vegetation. Passing on to consider the extent of the present production of oil, and the method employed in drilling for it, the author proceeded to deal in great detail with the chemical and calorific values of natural and artificial crude liquid hydrocarbons. He personally carried out a number of analyses, as well as investigated others made by different inquirers. Some of the results are given in the following table:—

Character of Fuel.	Chemical Constitution.				Calculated Calorific Value. British Units.
	C.	H.	O.	Sp. Gr.	
Average of five samples of—					
Baku petroleum	86·90	12·40	0·60	0·906	20·316
„ astatki	84·90	13·90	1·20	..	20·927
Pennsylvanian heavy crude oil	84·90	13·70	1·40	0·886	20·736
Caucasian heavy crude oil	86·60	12·30	1·10	0·928	20·138
„ light crude oil	86·30	13·60	0·10	0·884	22·037
Virginia petroleum	88·30	13·90	0·80	..	18·188
„ astatki	87·10	11·70	1·20	0·928	19·883
Shale, or dead oil	86·48	7·06	0·46	..	..
Blast-furnace oil	83·60	10·59	5·93	..	16·080 Actual
English coal (average of 98 samples)	80·00	5·00	8·00	1·250	14·112
German coal	72·00	4·67	10·98	..	13·404
Cellulose	44·00	6·17	49·10	..	65·510
Wood	39·00	Combin'd water	40·00	..	Actual expt. 76·85

Taking the average thermic value of the natural liquid hydrocarbon (astatki) to represent 20,000 British units, and that of coal to represent 14,000 units, the ratio for a unit of weight is 10 to 7 in favour of the natural liquid hydrocarbon. There was a net efficiency, during an actual working evaporative condition, of 85 per cent. easily attainable with crude liquid hydrocarbon, but the best ordinary working efficiency with solid hydrocarbon or coal did not realize more than 70 per cent. So that the relative value in practice was as 85 to 49 in favour of the liquid hydrocarbon, without allowing for the other advantages favourable to the use of oil. The cost of crude oil should not, however, exceed 22s. 6d. per ton to enable it to compete successfully as fuel with coal delivered at 12s. 6d. per ton. With regard to the use of oil for steam raising on board ship, the author pointed out its advantages in the way of convenience of storeage, and its possible utilization as a "sea calmer;" at the same time he admitted that it is liable to cause serious explosions. Having described the three methods at present in general use for utilizing oil for heating purposes, Mr. Thwaite explained his own system, which is based on that of Barff. In it the liquid hydrocarbon is injected by steam or air into the centre of a retort placed in the furnace of the steam generator; the steam and oil pass and repass, or flow circumferentially through the retort, becoming, by contact with the sides of the latter, converted into gas. The gas issues in an annular ring from the front end of the retort, where its flow is deflected around the retort by means of a disc-valve. The gas issues in a ring-like form around the edge of the retort, which is supported by a central wall, and flows along the outside of the retort in a column of flame. The air flows around the disc-valve, and meets the annular flow of gas. The author next dealt with the application of crude oil for heating and metallurgical purposes (giving the results of a number of trials); and then passed on to the last division of his subject—the use of oil for lighting. He explained the *modus operandi* of the Lucigen light, and made passing allusion to the great assistance this appliance has been in connection with the erection of the Forth Bridge. The mention of this light naturally led to a reference to the Luminator, the Wells, and the Doty lamps, which, though on similar lines, are rather simple arrangements. In the Sunlight—another lamp of the same class for burning crude oil—the pressure necessary to produce a continuous flow of the combustible agent for producing the light is due to the expansion of the gas resulting from the volatilization of the oil. The author concluded by discussing the merits of this lamp as compared with the "spray" systems, and showed that while it possesses certain advantages over its rivals, a longer time is required for the production of a steady light. The photometric value of the lights produced by the different methods for a given consumption of oil has not been ascertained; and Mr. Thwaite thinks it would be interesting if these were tested by independent experts. The author is now conducting experiments in generating a fixed gas from crude oil for gas motor purposes; but the experiments are not sufficiently advanced to permit any conclusions to be drawn therefrom.

THE LEAD-POISONING IN THE BRADFORD WATER-SUPPLY DISTRICT.

A conference of representatives of the North Bierley, Drighlington, Shelf, Calverley, Pudsey, Birkenshaw, Birstall, Gomersal, Liversedge, and Cleckheaton Local Boards has recently been held at Bradford, in regard to the lead-poisoning which has been for some months continually occurring in their respective districts, which are supplied with water by the Bradford Corporation. Many of the statements of the various delegates were very similar to those which had been made previously at the meetings of these Local Authorities, and which have been noticed from time to time in our columns. The most important feature in the proceedings was a report on the question by Professors Crace Calvert and Thomson, which was introduced by Mr. Jones, of North Bierley. Before reading the report, Mr. Jones remarked that there had been more than 100 cases of lead-poisoning in the North Bierley district. As soon as the Board received intimation of the existence of lead-poisoning, they put themselves into communication with the Corporation, and samples of water were analyzed. In water taken after leaving the mains lead was found in sufficiently dangerous quantity; and they found the matter to be so serious that they deemed it advisable to obtain the opinion of some outside authority on the subject. They took some lead piping from houses in which there were cases of lead-poisoning. In one case the piping had been in use for many years; in another, for only a short period. An old pipe was taken from a house where five people had suffered, and a new pipe was taken from the Wibsey Park Lodge. These were sent to the laboratory at the Royal Institution, Manchester, and Professor Thomson was asked to furnish an opinion upon them. The Professor sent for samples of water both from the mains and from a house where there had been a serious case of poisoning; and that morning he (Mr. Jones) had received a report. This he then read. It stated that the water was comparatively free from saline matter; and it would therefore on this account be more likely to attack lead than waters more highly charged with mineral constituents. It, however, contained practically no nitrates, which one would expect to find in large proportion in a water which had acted strongly on lead. The chief saline constituent of the water was sulphate of lime; and waters with that substance present were more liable to attack lead than waters containing larger proportions of carbonates of lime and magnesia than was found in the sample. The sample was also practically free from silica, which, if present, would exercise a deterrent effect on the solvent action of the water upon lead. The comparative action of distilled water upon the two samples of lead pipe which was sent to the Professors, was determined in comparison with a sample which they had in the laboratory. They ascertained that the same water dissolved rather more lead from their own sample than it did from either of those submitted to them. They then cut small pieces from each of the lead pipes, so as to get a clean metallic surface, and shook these up with distilled water; and again found their own sample was dissolved to a greater extent by the water than either of the other two samples. They next placed a sample of Manchester water and a sample of North Bierley water ("taken from the mains") respectively in two pieces cut off from the coil of lead pipe marked "Taken from the house occupied by John Hill, Storr Hill, Wyke;" and the same experiment was made with two pieces cut from the other coil, marked "Taken from Wibsey Park Lodge," after each had been thoroughly cleaned. In the first pipe the sample of Manchester water had dissolved more lead than the sample which was sent them (after each pipe had been cleaned from any adhering matter without scratching the surface); whereas in the other the two waters dissolved about equal quantities. From these results, the report continued, it would appear that the water in its present condition is not more liable to attack lead pipe than Manchester water. Still it was advisable something should if possible be done to prevent the action of the water on the pipes, and Professors Calvert and Thomson advised one or both of the following methods:—First, that the water, before entering the mains, should be passed through a considerable layer of a mixture of ordinary limestone and flints, broken into as small pieces as possible, so that the water might come into contact with both. By this means a small quantity of both silica and carbonate of lime would be taken up, neither of which (being in such small quantity) would be objectionable when contained in the water for domestic purposes. Minute quantities of these substances would tend very materially, even in presence of nitrates and nitrites, to prevent the solvent action of water on lead. The second plan recommended was to make it compulsory in the future to employ tin-washed instead of ordinary lead pipe in bringing the supply to the houses. Mr. Jones eventually submitted the following resolution: "That the representatives of the various townships consuming water from the Bradford Corporation, having considered the recent lead-poisoning epidemic and its possible remedy, while recognizing the fact that the water as supplied in the mains is free from lead, desire to express their conviction that some means ought to be taken to provide a deterrent constituent in the water; and they recommend that the water on the high level be passed through a layer of limestone and flint broken into small pieces." Mr. Mann, of Birstall, seconded the motion, which was unanimously adopted. Three gentlemen were afterwards appointed as a deputation to wait upon the Bradford Corporation to submit the foregoing resolution.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday.*

Evil times have fallen upon the St. Andrews Gas Company. Provost Paterson, one of its Directors, is a public-spirited man; but his public spirit has, on this occasion, led him into a position which is by some held to be antagonistic to his duty in the capacity of Director. The Provost is at the head of a movement for the transfer of the Company's undertaking to the Town Council. He at one time anticipated that it might be acquired for £10,000; but has since advanced his price to £13,250. The question of price depends on the method of fixing it; and the usual tactics of the seller have been resorted to, of concealing as far as possible the data upon which a purchaser might proceed in estimating the value of the subject to be bought. It is a pity that it is nearly always thus; and that the terms for the transfer of gas undertakings should, in most cases, depend more upon the force of character of the negotiators than upon the value of the undertaking. In the carrying out of their policy, the Directors of the Company have, as a body, refused the Provost—their co-Director—access to the Company's books, with the result that the latter has applied to the Court of Session for an interdict against them ordering their Manager to refuse him access. In support of his application, he states that the Company was originated in 1834, with a capital of £2500 in £10 shares; but that to such an extent has secrecy been carried, that he, although a Director, is not aware whether the capital is still at this figure, or has been increased. He has been a Director since 1884. On Dec. 12 last he called at the office of the Company, and asked to be allowed to take a list of the shareholders. The Manager and Secretary (Mr. J. Hall) refused to allow him; and the Directors afterwards, by five votes to four, approved of Mr. Hall's action. He then applied for a copy of the deed of co-partnery; but this also was refused him. He claims to have a right, as Director, to see the books of the Company at any time. In reply to this, the Directors say that the deed of co-partnery provides that no partner shall be entitled to inspect the books, except a Director or Committee of partners for two weeks before and two weeks after the first Tuesday in September. The Provost, they say, had not been authorized to obtain a list of the shareholders; and his sole object in seeking it was to use it against the interests of the Company. He has, they go on to say, since October last, been acting entirely on behalf of the Town Council against the Company, and has used his utmost exertions to force the Company into accepting the terms he has proposed. The Company has no objection, as at present advised, to sell its works and undertaking at a fair price fixed by arbitration; but the price proposed is quite inadequate and unfair. The complainer has threatened that, if the terms are not accepted, he will form another Company to compete with the existing Gas Company. It is solely, they believe, with the view to carry out the said hostile objects that he desires to obtain possession of the list of shareholders and other papers of the Company. He has not been refused, and the respondents have no intention of refusing him, any access or information required by him to discharge his duty as Director, or to protect the interests of the shareholders, or supervise the management. The alleged refusal by the Directors they considered to be an expedient and necessary step to safeguard the interests of the shareholders, because of the complainer having made the requisition with the view of committing a breach of his duty as Director, to the prejudice of the Company's estate. It is pleaded that the respondents acted within their duties, and also that the application to the Court is incompetent in respect that the contract of co-partnery provides for all differences among partners being settled by arbitration. The Directors of the Company met on Wednesday; and had rather a lively meeting. Mr. Andrew Aikman, who presided, alluded to the fact that he had been 17 years Chairman of the Company, and went on to say that the Company had been very prosperous during the whole period of 38 years that Mr. Hall had been connected with it; and it never was more flourishing than at present. The Directors' meetings had until lately been uniformly extremely pleasant; and the affairs of the Company were conducted in an orderly and businesslike manner. Recently, however, one of their number had taken an ill-feeling to Mr. Hall, and the Directors' meetings were now very disagreeable; and at present the majority of the Board were taken to the Court of Session for doing what they conscientiously believed was their duty to the shareholders. The service of the Court of Session summons upon him had so affected his health that he felt unable longer to continue to occupy the chair, which he resigned, and moved that Mr. J. Ritchie Welch be elected his successor. Mr. Welch was unanimously elected; and then, after a good deal of wrangling, it was agreed that Provost Paterson, who was present, should be furnished with a copy of the deed of co-partnery, at his own expense; and the Directors approved of the action of the majority in defending the Court of Session action.

The Arbroath Gas Corporation met last Tuesday to consider the report of their Special Committee on the question of extending the gas-works. The Committee, having considered the report of Mr. Foulis, recommended—(1) That the main from the works to the lower levels of the town be laid at once; (2) that new purifiers be erected as soon as this can conveniently be done; (3) that retorts and settings having regenerative furnaces be adopted; (4) that as Mr. Carlow was clearly of opinion that the town in the summer months could, with extra care and attention, be sufficiently supplied with gas from the small holder, the large holder should be telescoped. This, as stated in Mr. Foulis's report, would give additional storage capacity of 178,000 cubic feet. This addition to the present supply of 212,000 feet afforded by the present large holder, ought to be sufficient to serve for at least ten years to come, and would enable the Corporation to discontinue the small gasholder, which, Mr. Foulis reported, "is very much out of repair, and must either be reconstructed or abandoned." The Committee were of opinion that the erection of plant for the manufacture of secondary products might be left over for reconsideration at a future time. The probable cost of carrying out the extensions now proposed was as follows:—New main, £370; new purifiers, £1100; new governor, £100; regenerative furnaces, £1200; telescoping large holder, £2600; alterations on purifier buildings, £100—total, £5470, say, £5500. This sum the Committee suggested should be charged as follows:—Against capital, and to be borrowed under the Corporation Gas Act, £4000; against maintenance, and to be carried to suspense account, and to be wiped off by instalments extending over some years, £1500. Provost Anderson moved approval of the report; but, after discussion, the subject was sent to the Works Committee to consider and report as to what work was necessary. It will be observed that the proposal of the Committee, if carried out, will leave the gas-works with only one holder. Provost Anderson referred to this, stating that he thought it inadvisable; but had agreed to it in view of the fact that the ratepayers considered they should spend as little money as possible. My "Notes" of last week, I regret to say, did not accurately describe Mr. Mitchell's recommendation on one particular point—that of the gasholders. Having had an opportunity of referring to his report, I find that what he recommended was not, as stated, to construct a new holder, and to telescope the existing large holder, but to erect a new holder and to make provision "so that at some future time it may be telescoped."

Messrs. George Mackay & Co., brewers, of Edinburgh, have brought against the Edinburgh and Leith Gas Commissioners an action similar to the one they were recently unsuccessful in against the Edinburgh Gas Company. They seek declaration that the Commissioners are not entitled to manufacture or store gas at their premises in Canongate in such a way as to contaminate the water in or coming into the well situated in St. Margaret's Brewery, belonging to the pursuers. Interdict is also asked; and £5000 in name of damages. The previous action was thrown out by Lord Wellwood on the ground that the Company were not liable; the business having been, before the raising of the action, transferred to the Corporations. It is pleaded by the Corporations in this action that they are not liable for pollution prior to Aug. 1, 1888. It is averred that the pursuers' well communicates with other wells in the vicinity; that there are several gutters and sewers close by, from which sewage passes into the well, and that the well is also polluted by discharges from public works and manufactories not belonging to the Commissioners. They plead that pursuers have suffered no loss for which they are liable, and found upon the provisions of the statute. The present action has also been brought before Lord Wellwood, who on Tuesday closed the record, and sent the case to the roll for discussion.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday.*

In the minutes of the Gas Committee submitted at the meeting of the Glasgow Town Council last Thursday, it was shown that the revenue derived from the sale of residual products for the financial year up to Jan. 31 was £41,583, against £29,655 at the same time last year; thus showing an increase amounting to £11,917 16s. At the same meeting one of the Councillors asked for information as to the amount represented by the contracts accepted for the reconstruction and extension of the Tradeston Gas-Works. Ex-Bailie Ure, who is practically the head of the Gas Committee, stated, in reply, that the complete contracts for carrying on all the operations in connection with the reconstruction had been accepted, but that it would be unwise, he considered, to publish details of the cost of those contracts in the meantime. I am not in a position to give all the details referred to by Mr. Ure; but I may state that the amount of money which it is intended to lay out at present is about £60,000, exclusive of the cost of the additional ground required for the extensions that have been resolved upon. This may perhaps satisfy the inquiring Councillor.

The Directors of the Saltcoats Gas Company have contracted for the erection of a new cast-iron tank and gasholder; the former being 61 feet in diameter, and the latter having a capacity for 50,000 cubic feet of gas. Including other improvements, the expenditure now resolved upon will be about £2000.

An important extension of the Corporation gas-works has been resolved on by the Gourock Police Commissioners, as it is considered that there will be a large demand made for gas by the Caledonian Railway Company, owing to the extension of that Company's railway system to Gourock Pier, to and from which there is expected to be a good passenger traffic. It is also anticipated that there will, in consequence of the railway extension to the town, be a great addition to the resident population.

At Innellan, which is a watering-place on the Clyde, quite near to Dunoon, the price of gas is 9s. 7d. per 1000 cubic feet, and yet the local Gas Company are unable to pay a dividend. Rothesay householders who grumble at the price of their gas being 4s. 2d. per 1000 feet, with 5 per cent. for prompt payment, are requested by a local paper to think of this, and tremble.

Last Wednesday, the monthly meeting of the Kilmarnock Town Council took place; and part of the business was the consideration of the monthly report from the Gas Committee. It stated that at next Whitsunday term mortgage bonds to the amount of £11,825 would fall due; and the Committee reported that they had resolved to pay off £3000 of the same, and renew the balance of £8825 at 3¼ per cent. for five years. In moving the adoption of the report, Treasurer Ferguson stated that the Committee had carefully considered the position before making their recommendation. Such a resolution might, he said, be regarded as somewhat dangerous in anticipation of the coming balance due in Midsummer, but for the fact that for some months back they had had sufficient funds in deposit and on current account to meet it; and they were satisfied that there would be no danger in doing as stated. After further explaining the financial position of the Council as a Gas Corporation, he stated that the Committee hoped and trusted that by another year they would be able to make a reduction in the price of gas.

The Glasgow pig-iron market has been strong during the past week, and the price of Scotch warrants advanced from 42s. 5d. to 43s. 11½d. per ton cash on Wednesday; but the close yesterday afternoon was much easier, with buyers offering 43s. 7d. per ton cash. A large amount of business was done in hematite and Cleveland iron warrants at from 46s. 8½d. to 47s. 2½d. per ton for the former, and 36s. 9d. to 37s. 2d. per ton for the latter; while the closing prices yesterday were 46s. 9d. and 36s. 8d. per ton respectively. Scotch special brands have been in greater demand; and the prices have in almost all cases been advanced—in one instance, 2s. per ton.

A quieter tone is now making itself felt in the coal trade; but there is still a large demand for inland consumption. Prices in all departments remain unchanged, but very firm. Some merchants have lately been giving out orders very liberally.

THE WATER QUESTION AT STAINLAND.—Considerable attention is being given to the question of water supply at Stainland. The Local Board has promulgated one scheme which has aroused intense opposition; and there is also a proposal by the Deanhead Commissioners to supply the district from their reservoir. Yesterday week the Local Board decided to appear in opposition to the Commissioners' Bill, which is now before Parliament; and on Thursday there was a meeting of the ratepayers on the subject. It was explained that the Local Board require the following provisions to be inserted in the Commissioners' Bill:—1. That the Local Board shall have power to obtain water in their own district, or from any other source they think best, and be in the same position they are in at present. 2. If the Board should take water from the Commissioners, the price is not to exceed 4d. per 1000 gallons at the boundary of the district. 3. That the Local Board shall not be bound to take any specific quantity, except giving notice yearly what they might take during the current year. 4. That the Commissioners shall not compete with the Local Board in supplying the district, if the Board can supply the district on reasonable terms. 5. That the Commissioners must not draw from their reservoir for the use of the mills, if there is less than 150 days' supply upon the quantity from time to time agreed to be taken by the Board for domestic purposes. 6. That the Commissioners shall make good all damage done to the roads in the district. A resolution authorizing the Board to present a petition against the Bill was passed; but a poll was demanded.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 9.

Sulphate of Ammonia.—The unfavourable condition of the market has continued during the greater part of the week. Lower figures were accepted all round; and £11 15s. was about the top value accorded by buyers, rather better prices being, however, obtainable for high-class makes. The weather is still strongly against a material increase of demand, from consumptive quarters; nevertheless, the tone to-day may be said to be steadier, and the feeling of intense depression seems to have passed away. It is not easy even now to forecast the future; but if appearances do not deceive, the downward course seems to be checked, at all events for the present. Nitrate keeps very steady—being well held; although the statistics are not as favourable as holders may wish them to be. The quantity afloat on the 1st inst. was about 60,000 tons; and the stocks, about 40,000 tons in excess of last year.

LONDON, *March* 9.

Tar Products.—Very little new business is being done; the leading products being entirely neglected by buyers. Large business is doing in the commoner oils; and crude carbolic acid is in excellent request. Very heavy shipments of pitch are taking place; and the end of the season will find tar distillers clearer of stocks in this article than has been the case for many years. Prices: Tar, 18s. to 23s. per ton. Benzol, 90 per cent., 2s. 10½d. per gallon; 50 per cent., 2s. 2½d. Toluol, 1s. 5d. per gallon. Solvent naphtha, 1s. 3d. per gallon. Crude naphtha (30 per cent.), 1s. per gallon. Light oil, 3d. per gallon. Creosote, 2d. per gallon. Pitch, 20s. to 23s. per ton, according to position. Carbolic acid (crude), 3s. 10d. per gallon. Cresylic acid, 10d. per gallon. Tar salts, 17s. per ton. Anthracene (30 per cent.), "A" quality, 1s. 3d. per unit; "B" quality, 1s. 1d.

Ammonia Products.—Sulphate is difficult of sale; and its value has a downward direction. An improvement in the weather would undoubtedly stop this downward course, and sulphate may be expected to reach £12 again. Sales have been made during the week at prices ranging from £11 15s. to £11 17s. 6d. per ton. Prices of other products may be taken as follows:—Gas liquor (5° Twaddel), 8s. per ton, with a rise or fall of 1s. 6d. per degree. Liquor ammonia, 2d. per lb. Carbonate of ammonia, 3d. to 4d. per lb. Muriate of ammonia, brown, £19 per ton; white, £25 per ton. Sal-ammoniac, £30 to £33 per ton.

NEW CONDENSING PLANT AT THE FARNWORTH GAS-WORKS.—The Farnworth Gas Company, Limited, have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for a set of four large wrought-iron annular condensers of the same size as those erected some years ago by them.

THE BRUSH ELECTRIC LIGHT COMPANY.—This Company last year made a gross profit of £28,049, to which was added £2562, the balance from 1887; making £30,611 in all. Of this amount £2995 was absorbed for general charges, such as rent, taxes, and fuel; £1321 for Directors' fees; £5428 for salaries; £1038 for printing, postage, &c.; £2037 for advertising, agency, &c.; £2800 for maintenance and depreciation of plant; and £800 for bad debts. The net profit was £12,885 4s. 9d., or equal to more than 5 per cent. on the total capital of the Company. One naturally turns, says *Engineering*, to see the cost of the late litigation. It is entered in a suspense account, as £17,484, pending the appeal to the House of Lords. If this appeal should be lost, it will involve a heavy drain on the Company's resources. The patents and goodwill are valued at £59,423; the property at £84,766; and the stock at £68,229; while £48,531 are owed by the customers of the Company. The Directors report that the volume of business in 1888, as compared with that of 1883, was as 307 to 100—showing an advance in the five years of upwards of 200 per cent; while the gross profits have increased in the ratio of 100 to 342·9, or over 242 per cent., and the standing charges have fallen in a ratio of 100 to 65. This does not include the foreign business, which is doing well. The present year has, it is said, opened with a great increase of orders over the last; and there is every prospect that it will be one of great prosperity.

THE BIRMINGHAM CORPORATION AND THE SALE OF GAS-FITTINGS.—At the meeting of the Birmingham City Council last Tuesday, a memorial, signed by a number of gas-fitters and lamp-makers in the city, was presented, protesting against the competition to which they allege they are subjected by the Corporation undertaking the sale and fixing of gas-fittings, and asking for the appointment of a Committee, before whom members of the trade could attend and give evidence, to fully investigate the conduct of the Gas Department in this matter. Mr. Lowe, who presented the memorial, remarked that, although the proceedings of the Gas Committee were called in question, he thought the matter should be referred to them in the first instance, so that the Council might hear what they had to say upon it. Mr. Jarvis remarked that the memorial asked for an inquiry to be instituted. He took it that a Special Committee, which would be in a better position to deal with the matter than the Gas Committee, was meant; and therefore he would move, as an amendment, that the memorial be referred to a Special Committee to be hereafter named. Alderman Manton said he thought the amendment would be a deliberate insult to the Gas Committee. Alderman Downing said that, in his opinion, the matter should go to the Gas Committee. Mr. Lowe, in reply, urged that the Gas Committee should have an opportunity of reporting to the Council before any Special Committee was appointed; and eventually the motion was carried.

ADDITIONAL WATER SUPPLY FOR MALVERN.—At the meeting of the Malvern Local Board last Tuesday, reports of considerable length were read from Mr. G. J. Symons, F.R.S., and Mr. William Topley, F.R.S., on the geological and meteorological aspects of the water supply question, and from Mr. Mansergh, the Structural Engineer employed by the Board. Dr. Pole, the Consulting Engineer, had advised large storeage reservoirs on the Wells Common, which the Board fell in with; but Mr. Mansergh, after obtaining information from all quarters, and making practical surveys, now recommended the Board not to increase their supply by the interception and storeage of water flowing over the surface of the hills above the town, but only by an improvement and expansion of the method now adopted of collecting water which has percolated below the surface, and is flowing underground. He thought it desirable for the Board to try and acquire the Tudor House Wells. The amount of underground storeage should be enlarged by sinking shafts and wells in the red sandstone rocks in selected places at the southern end of the district, where the "fault" in the Malvern Hills was known to be most open. He thought that £1000 might be prudently expended in this way. He also recommended that the present system of collection in the valleys by underground dams and pipes be improved and extended. The supply of water from the red sandstone was of a much more permanent and reliable character than that from the surface of the hills. After discussing the matter, it was agreed that Mr. Mansergh's report should be adopted in so as may be necessary to meet the exigencies of the present time.

NOTTINGHAM ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—At the meeting of the Nottingham Town Council yesterday week, a letter was read from the Solicitors of this newly-formed Company asking for the consent of the Corporation to the putting down of electric light wires in the borough. A resolution was agreed to appointing certain gentlemen named therein a Committee, to advise the Town Council as to the propriety of giving such consent, and the terms and conditions upon which it should be given. The Committee are also to consider the "whole matter" of the lighting of the borough or any part by electricity.

CARLISLE GAS AND WATER WORKS BENEFIT SOCIETY.—The annual *soirée* of this Society took place last Thursday, under the presidency of the Mayor (Mr. J. R. Creighton). A varied programme of music was provided for the occasion; and a pleasant evening was passed. The Society was established in 1872 to afford relief to sick members, and to provide funds to meet funeral expenses. In the first year there were 22 members; now there are 70. The receipts have risen from £18 16s. 3d. to £57 12s. 2d.; and the expenditure from 15s. to £54 16s. 7d. From the commencement until now the members have contributed a total of £618 18s. 10d.; the Gas Committee of the Corporation adding £108 12s.—making a total of £727 10s. 10d. The Society has an investment to the extent of £344. Since 1878 medical attendance has been provided for the members.

THE FAILURES OF THE ELECTRIC LIGHT AT BARNET.—Writing to the *Barnet Press* on the 27th ult., Messrs. H. F. Joel and Co., the Contractors for the electric lighting of the district, say: "In pioneering the system of incandescent lamps in series for street lighting at High Barnet, we have had to contend with great opposition and unusual difficulties; but even taking into account the stoppage of the light owing to uncontrollable causes—such as wilful damage to our wires, &c.—the whole of the failures during the past six months and severe winter weather, has barely exceeded 1 per cent. of the total hours of lighting; and this we submit is very encouraging, and is, we believe, the best record of town lighting. In the opinion of many qualified engineers who have visited Barnet, the system of street lighting by 32-candle power incandescent lamps is a success."

THE PRICE OF GAS AT DUDLEY.—There is some dissatisfaction in Dudley with regard to the price charged for gas by the Gas Company, who, it is said, refuse to accede to any of the many requests made to them for a reduction. In moving the adoption of the Streets and Gas Committee's report, at the monthly meeting of the Town Council last Tuesday, Alderman Bagott referred to the matter, and said he hoped soon to be able to report a reduction. He gave some statistics of the cost of gas in neighbouring towns, and concluded by saying that electric lighting was making great progress; and before they considered the question of purchasing the gas-works, they should do what they could to get a competitive light for the borough, as he was sure the price now being charged for gas was acting prejudicially against the prosperity of the town. Alderman Howat thought it should go out to the public once for all that the Corporation could not purchase the gas-works at anything like a remunerative price. The report was adopted; and Alderman Howat then moved a resolution that a deputation should be appointed to wait upon the Directors of the Gas Company to urge upon them a reduction in price. The motion was unanimously agreed to.

NORTHERN COAL TRADE.—In the Northern coal trade, there is more activity; and the possibility of a strike in South Wales is causing some stiffness in the steam coal branch, whilst an actual outbreak would give an enormous stimulus to the trade. Best Northumbrian steam coals are now 10s. to 10s. 6d. per ton free on board, which is nearly 3s. above the price at the corresponding period of last year. Small coals are abundant. In the gas coal trade there is still the diversity of high prices asked for coals when sold in cargoes, and very low ones offered for contracts. As high as from 8s. to 8s. 6d. has been quoted for the former, whilst for coal delivered in Rotterdam as low as 11s. 8d. has been quoted; so that when freight at about 4s. 6d., insurance, lighterage, and commission, are taken off, there will be a very low price left for the gas coals free on board. The demand for this class is still large, though the local consumption is falling off. The shipments, however, must soon be increased by the opening of the Baltic ports. For gas coke, which is in good request, some of the companies are obtaining from 1s. to 1s. 6d. per ton more than they did a year ago; this increase, of course, being accompanied by an increase in the selling price of ordinary coke.

SUGGESTED PURCHASE OF THE KETTERING WATER-WORKS BY THE LOCAL BOARD.—The negotiations with a view to the purchase of the Kettering Water-Works by the Local Board, proposed some months ago, do not appear to have made much headway. About three months ago a town's meeting decided to authorize a Committee to obtain particulars; and another town's meeting, convened by the Committee, was held yesterday week, to further consider the question. Mr. T. Wallis, who was voted to the chair, in the course of a lengthy speech, said it would, of course, be useless to proceed in the matter unless the town was prepared to offer some £5000 or £6000 as a premium on the shareholders' property. With this knowledge, he thought the meeting need not be very long in coming to some decision; and with this view he proposed the following resolution, drawn up by the Committee:—"That, in the opinion of this meeting, it is desirable that the Local Board be requested to make an offer to purchase the undertaking of the Kettering Water-Works Company, and that a Committee be formed to confer with the Board and make suggestions to them as to the terms to be offered to the Company." The resolution having been seconded, some discussion ensued, in which there appeared to be a great deal of opposition. Eventually, however, the motion was carried; and a Committee was appointed to confer with the Company.

PROPOSED WATER-WORKS FOR OUNDLE (NORTHAMPTON).—An order having been received from the Local Government Board to provide a water supply for the town of Oundle, in consequence, as it is alleged, of the Local Sanitary Authority having made default in that respect, a great amount of feeling in opposition thereto has been shown among the inhabitants, and last Tuesday week a meeting was held in the Town Hall to consider the best means of protesting against the proposed introduction of water-works in the town. An animated discussion took place on the question; and in the end, it was resolved to forward a memorial which had been drawn up to the President of the Local Government Board. In this it is represented that a very large majority of the resident ratepayers consider the proposed outlay unnecessary and oppressive, for reasons given, prominent among which are the following:—That the introduction of water-works is desired by a very few of the ratepayers, if any, besides the Grocers' Company and their local representatives; that the order for the water-works is based not upon the insanitary condition of the town, but, so far as the memorialists are aware, upon an analysis of the water from the public wells procured by the Grocers' Company; that other analyses have been made of the same water besides that above mentioned, and that they differ considerably from those made on behalf of the Grocers' Company; that the town is amply supplied with water from private sources beside the public wells; and that the sanitary condition of the town is perfectly good.

SULPHATE MAKING AT THE JERSEY GAS-WORKS.—The old sulphate apparatus at the Jersey Gas-Works is being entirely replaced by plant on the continuous system by Messrs. R. and J. Dempster, of Manchester.

EXTENSION OF THE BRIDLINGTON GAS-WORKS.—These works are about to be extended by the addition of a new retort-house, the ironwork of which is being executed by Messrs. R. and J. Dempster, of Manchester.

GREAT MARLOW WATER COMPANY, LIMITED.—This is the title of a Company registered on the 25th ult., with a capital of £15,000 in £10 shares, to supply the town and neighbourhood of Great Marlow with water, gas, and electricity.

SALE OF SHARES AT CHATHAM.—At a sale by auction at Chatham last Saturday, ten fully-paid shares in the Brompton, Chatham, and Gillingham Water Company realized £16 each; eight new shares, £10 10s. each; three do., £10 12s. 6d. each; and two do., £10 15s. each.

EXTENSIONS AT THE KENDAL GAS-WORKS.—The Kendal Union Gas and Water Company, Limited, are making some extensive additions to their gas plant. They include six cast-iron purifiers 16 feet square by 5 feet deep, with sieves, wrought-iron covers, &c., complete. Also two sets of lifting apparatus on the Goliath principle; two sets of oxide elevators, &c.; a complete superstructure for carrying the purifiers; and patent centre-valve and connections. The designs have been prepared by the Company's Engineer (Mr. E. Thompson); and the carrying out of the whole of the contract has been entrusted to Messrs. R. Dempster and Sons, Limited, of Elland.

LADDER *v.* POLE LIGHTING FOR THE PUBLIC LAMPS IN BELFAST.—At the meeting of the Belfast Corporation on the 1st inst., the question of substituting poles for ladders in lighting the public lamps, which had been under the consideration of the Gas Committee, was discussed, on a recommendation by the Committee that the present system should be continued. An amendment to refer the matter back to the Committee, for the purpose of obtaining statistics as to the two methods of lighting the lamps, was submitted; but, it having been explained that the pole lighting would entail additional expenditure to the extent of about £1200, the recommendation was agreed to.

RASTRICK WATER SUPPLY.—Yesterday week there was a meeting of the ratepayers of Rastrick, to consider the matter of petitioning against the action of the Water Company in applying to Parliament for the incorporation of the Company and the raising of £9000 additional capital; making £15,000 in all. Mr. Firth, Chairman of the Local Board, who presided, said the members of the Board had done everything in their power to settle the matter amicably, but had failed. They had offered £7000 for the undertaking; but the Company had not acknowledged the offer. There was now nothing for the ratepayers to do but petition against the Bill, and support the action of the Local Board. A resolution authorizing opposition was carried with a few dissentients.

THE VYRNWY WATER-WORKS.—The comparatively dry weather of the last two months has resulted in the filling of the new Vyrnwy reservoir proceeding much less rapidly than was anticipated. Up to the 2nd inst., the quantity of water stored there was 5500 million gallons, or rather more than half its capacity. The rainfall in this part of Wales is, however, very heavy; so that rain for a week or two would enormously increase, if not entirely complete, the estimated quantity of water the lake will hold. The work of driving the tunnel under the Mersey is progressing satisfactorily and rapidly; the air-drills having been recently started in the bottom of the shaft, and the work of the main tunnel under the river commenced.

NORTHERN GAS COMPANY OF MELBOURNE.—The half-yearly general meeting of the Northern Gas Company of Melbourne was held on Monday, the 28th of January. The Directors in their report stated that progress had been made in the Company's business. Gas was supplied for the first time on the 13th of August last, when the number of consumers was 74; whereas on the previous Wednesday there were 99, and 57 more had applied for a supply. Altogether 11 miles of mains had been laid, involving an expenditure of £7880. The existing arrangement, by which the Company obtained their gas in bulk from the Metropolitan Gas Company, would no doubt answer for the present; but if the Directors found they could manufacture it themselves at less cost, they would consider the advisability of erecting their own works. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 476.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d
590,000	10	12 Oct.	10½	Alliance & Dublin 10 p. c.	10	18½—19½	..	5 7 8
100,000	10	„	7½	Do. 7 p. c.	10	13—14	..	5 7 8
800,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	100	110—112	..	4 9 9
100,000	20	29 Nov.	10	Bahia, Limited	20	24—26	..	7 13 10
200,000	5	14 Nov.	7½	Bombay, Limited	5	6¾—7¼	..	5 8 5
40,000	5	„	7½	Do. New	4	5¼—5¾	..	5 4 2
880,000	Stck.	14 Feb.	11½	Brentford Consolidated	100	223—226	..	5 3 1
125,000	„	„	8½	Do. New	100	163—168	..	5 4 3
220,000	20	13 Sept.	10½	Brighton & Hove, Original	20	43—45	..	4 13 4
320,000	20	28 Sept.	11½	British	20	46—48	..	4 13 9
50,000	10	18 Sept.	11	Bromley, Ordinary 10 p. c.	10	20—22	..	5 0 0
39,000	10	„	8	Do. 7 p. c.	10	18½—14½	..	5 10 8
328,750	10	14 Nov.	8	Buenos Ayres (New) Limited	10	14—15	..	5 6 8
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	107—110	..	5 9 1
150,000	20	28 Feb.	8	Cagliari, Limited	20	25—27*	..	5 18 6
550,000	Stck.	12 Oct.	13½	Commercial, Old Stock	100	268—273	+1	5 0 8
180,000	„	„	10½	Do. New do.	100	x15—220	..	4 17 9
180,000	„	28 Dec.	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 8
557,320	20	13 Dec.	13	Continental Union, Limited	20	48—50	..	5 4 0
242,680	20	„	13	Do. New '69 & '72	14	34—36	..	5 1 0
200,000	20	„	10	Do. 7 p. c. Pref.	20	38—40	..	5 0 0
75,000	Stck.	28 Sept.	10	Crystal Palace District	100	205—215	..	4 13 0
234,060	10	30 Jan.	13	European, Limited	10	25¼—26¾	..	4 18 1
120,000	10	„	13	Do. New.	7½	18—19	..	5 2 7
354,060	10	„	13	Do. do.	5	12—13	..	5 0 0
5,468,600	Stck.	14 Feb.	13	Gaslight & Coke, A, Ordinary	100	255—259	..	5 0 5
100,000	„	„	4	Do. B, 4 p. c. max.	100	99—104	..	3 16 11
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	138—138	..	3 18 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	180—185	..	4 1 1
1,800,000	„	„	7	Do. H, 7 p. c. max.	100	170—175	..	4 0 0
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	258—263	..	3 16 1
1,061,150	„	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	120—123	..	3 5 0
294,850	„	„	4½	Do. 4½ p. c. do.	100	125—130	..	3 9 3
650,000	„	„	6	Do. 6 p. c. do.	100	174—179	..	3 7 0
5,600,000	Stck.	14 Nov.	10	Imperial Continental	100	210—214	..	4 13 5
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd	5	5—5½	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	29 Nov.	6	Monte Video, Limited	20	18½—19½	..	6 3 1
150,000	5	29 Nov.	10	Oriental, Limited	5	9¼—9¾	..	5 2 7
60,000	5	28 Sept.	7	Ottoman, Limited	5	6—7	..	5 0 0
166,870	10	16 Jan.	4	Pará, Limited	10	5½—6	..	6 13 4
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	104—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	95—100	..	6 0 0
100,000	10	12 Oct.	10	San Paulo, Limited	10	16—17	+½	5 17 8
500,000	Stck.	28 Feb.	16½	South Metropolitan, A Stock	100	314-319*	..	5 1 11
1,850,000	„	„	12½	Do. B do.	100	238-242*	..	5 0 2
141,500	„	„	13½	Do. C do.	100	255-265*	..	5 0 0
600,000	„	28 Dec.	5	Do. 5 p. c. Deb. Stk.	100	137—140	..	3 11 5
60,000	5	28 Feb.	11½	Tottenham & Edm'ntn, Orig.	5	11—13*	..	4 8 5
						*Ex div		
				WATER COMPANIES.				
717,467	Stck.	28 Dec.	9	Chelsea, Ordinary	100	259—264	..	3 8 2
1,720,580	Stck.	12 Oct.	7½†	East London, Ordinary	100	211—215	..	3 9 9
700,000	50	13 Dec.	9	Grand Junction.	50	122—126	..	3 11 5
708,000	Stck.	14 Feb.	10½	Kent	100	272—277	..	3 15 9
1,043,800	100	28 Dec.	9	Lambeth, 10 p. c. max.	100	254—259	..	3 9 6
406,300	100	„	7½	Do. 7½ p. c. max.	100	197—202	..	3 14 3
200,000	Stck.	28 Sept.	4	Do. 4 p. c. Deb. Stk.	100	118—122	..	3 5 7
500,000	100	14 Feb.	12½	New River, New Shares	100	350—360	..	3 7 4
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	100	123—126	..	3 3 6
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall. 10 p.c. max.	100	168—173	..	3 9 4
126,500	100	„	6	Do. 7½ p. c. do.	100	161—166	..	3 12 3
1,155,066	Stck.	„	10	West Middlesex	100	264—269	−1	3 14 4

† Next dividend will be at this rate.

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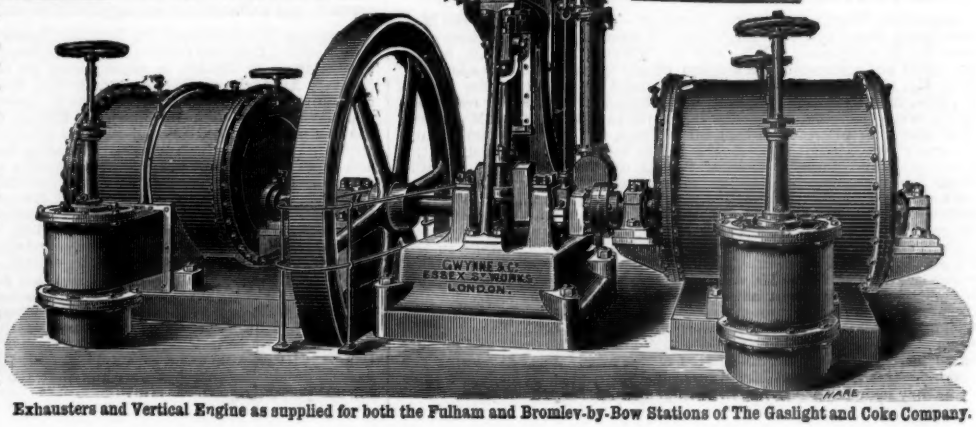

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THE GAS INSTITUTE.

THE Council respectfully request that all SUBSCRIPTIONS and COMMUNICATIONS relative to THE GAS INSTITUTE be addressed to Mr. William Longworth, Gas Offices, Guildford, who has been appointed Honorary Secretary, *pro tem.*
Dec. 29, 1888.

FITTER wants a Situation. Well up as Gas-Works Fitter. Willing to make himself useful. Married, steady, and industrious. Can be well recommended. Can leave present employment at once.
Apply to "FITTER," care of Mr. H. Wimhurst, Manager, Gas-Works, SLEAFORD.

WANTED, by a Total Abstainer, a Situation in a Gas-Works as WORKING MANAGER or FOREMAN. Has had good practical experience in Carbonizing, Fitting, Main and Service Laying, Reading Meters, and Repairs connected with Gas Plant. Good testimonials. Married.
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WANTED, an experienced Foreman for a small Gas-Works. House, Coal, and Gas, and Wages 25s.
Apply, with references, to Mr. WILLEY, Gas Engineering Works, EXETER.

WANTED, a thoroughly practical Meter REPAIRER for Wet and Dry Meters. Preference given to a Man having had experience in general Gas-Works Fitting, Smithing, Main Laying, &c.
Apply, stating wages and references, to the MANAGER of the Gas-Works, Drighlington, near BRADFORD.

WANTED, by a large Provincial Gas Company, a good RETORT SETTER. Must be a steady and industrious man, capable of taking charge of other men when required, and working from drawings. Wages, 38s. per week.
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WANTED, for the Hartley Wintney Gas- Works, near Winchfield, Hants, a MAN to take charge of the Works. Must be a Fitter, and able to repair the Tools. Wages, for the four Winter Months, 24s.; the eight Summer Months, 20s. per week, with House, Garden, Gas, and Firing.
Apply to Mr. KENWARD, Hartley Wintney, Winchfield, HANTS.

WANTED, Two second-hand Purifiers, about 6 feet square, with 5 or 6 inch Valves and Connections, also Lifting Gear complete.
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WANTED, a good Second-hand Centre- VALVE, 14 inch to 18 inch.
Price and particulars to SAML. WHILE, 60, Queen Victoria Street, LONDON, E.C.

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WANTED, a Second-hand Purifier, about 6 or 8 feet, for the West Cowes Gas-Works.
Send particulars of Fittings and Valves, and Cash Price, to Mr. ALFRED THOMAS, Manager.

TO GASHOLDER MAKERS AND OTHERS.

WANTED, by the Tetbury Gas Com- pany, Limited, a second-hand GASHOLDER to contain about 16,000 cubic feet. Must be in good condition, and available for use during the ensuing Summer.
For further particulars, apply to the MANAGER, Gas-Works, Tetbury, GLOUCESTERSHIRE.

FOR SALE—200 Fire Lumps, 9 in. by 9 in. by 6 in. Lying at Messrs. Harris and Pearson's, Stourbridge. Wrong dimensions given when ordered. No reasonable offer refused.
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IMPORTANT SALE OF SHARES.

MESSRS. HOOKER & WEBB have received instructions to SELL BY AUCTION at the Greyhound Hotel, Croydon, on Thursday, the 14th of March, 1889, at 6 o'clock precisely, in suitable lots
156 FULLY-PAID SHARES IN THE CROYDON GAS COMPANY,
at present paying dividends at the rate of 14 and 11 per cent. per annum.
The high standing of this Company, its excellent management, and with the prospect of increasing dividends, render the Shares a desirable Investment for large or small sums.
Particulars and conditions of Sale may be had at the Greyhound Hotel, and of the AUCTIONEERS, 4, High Street, CROYDON.

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[Telegraphic Address: "PRECISION LONDON."]
Makers of Wet and Dry Gas-Meters, Station Meters and Governors, Photometers, and Gas-Testing Apparatus, Test Gasholders and Meters, Registering and other Gauges, &c., &c.
*** See Advertisement on Page III. of the Wrapper of this week's issue.

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 457 of last week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

SHIPPING AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 9, Crosby Square, London, E.C., Shipping Agent to several Foreign Gas Companies, is prepared to attend to the Forwarding and Insurance of Goods for Foreign and Colonial Gas Companies, &c., and Gas Plant Manufacturers.
For Rates of Freight, apply as above.

FOR SALE—Körting Bros.' Gas Ex- hauster, No. 2, to pass 2000 feet per hour; also Vertical CROSS-TUBE BOILER, 2 ft. 6 in. diameter by 5 feet high, with all requisite Fittings and Adjuncts, including Patent Injector. Purchased in 1884.
Apply to the MANAGER of the Gas-Works, MILLOM.

GUILDFORD GASLIGHT AND COKE COMPANY.

ON SALE—One Livesey's Washer and One KIRKHAM'S WASHER, each 300,000 feet per day capacity. They are in perfect working order, and disposed of solely to make room for similar Apparatus of larger dimensions.
Any Gas Company having for Sale a Washer or Scrubber of above make, and for 500,000 feet per day, will please communicate with Mr. LONGWORTH, Gas Offices, GUILDFORD.
Guildford, March 9, 1889.

CORPORATION OF LONGTON.

GASHOLDER, ETC., FOR SALE.

THE Gas Committee have the following Plant FOR SALE (in good condition), and are prepared to receive OFFERS for the same:—
GASHOLDER 60 feet diameter, and 23 feet deep, and Framework.
CAST-IRON VERTICAL CONDENSER, suitable for a daily make of 250,000 to 300,000 cubic feet.
For further particulars and to view, apply to the undersigned.
W. W. HULSE,
Secretary and Manager.
Gas-Works, Longton, Staffordshire,
March 9, 1889.

COCKERMOUTH LOCAL BOARD.

TAR AND AMMONIACAL LIQUOR.

THE Cockermouth Local Board invite TENDERS for the Surplus TAR and LIQUOR produced at their Works during Twelve months commencing the 1st of April next.
Further particulars on application to the undersigned.
Tenders, endorsed "Tar and Liquor," to be addressed to the Chairman of the Gas Committee, and delivered at the Gas-Works, not later than Thursday, the 14th of March.
By order,
E. W. SMITH, Manager.

GLASGOW CORPORATION GAS.

THE Glasgow Corporation Gas Com- missioners are prepared to receive TENDERS for the Construction of an additional LIFT to a GASHOLDER, 160 feet in diameter, at their Gas-Works at Dawsholm, Maryhill.
Forms of tender may be obtained, and plans and specification seen, at the Gas Office, 42, Virginia Street, Glasgow.
Sealed offers, marked "Tender for Lift to Gasholder," and addressed to the subscriber, will be received at the Gas Office, on or before Tuesday, the 19th inst.
The Commissioners do not bind themselves to accept the lowest or any offer.
J. D. MARWICK, Town Clerk.
City Chambers, Glasgow, March 1, 1889.

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCTS FOR SALE, AND RESIDUAL PRODUCT WORKS TO LEASE.

THE Glasgow Corporation Gas Com- missioners are prepared to receive TENDERS for (1) the purchase of the TAR and AMMONIACAL LIQUOR produced at the Tradeston Gas-Works, from and after the 15th of May, 1889; and (2) the purchase of the TAR and AMMONIACAL LIQUOR produced at the Dawsholm Gas-Works from and after the 1st of July, 1889, and a lease of the RESIDUAL PRODUCT WORKS belonging to the Commissioners, adjacent to the Gas-Works, from and after same date.
Forms of tender, on which offers must be made, and copies of the "Terms and Conditions" upon which the Products are to be sold and the Residual Product Works are to be let, may be had on application to the Manager, at the Gas Office, 42, Virginia Street, Glasgow; and offers, endorsed "Tender for Tradeston Residual Products," or "Tender for Dawsholm Residual Products and Works," will be received by the subscriber, on or before Tuesday, the 26th of March next.
The Commissioners do not bind themselves to accept the highest or any tender.
J. D. MARWICK, Town Clerk.
City Chambers, Glasgow, Feb. 27, 1889.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour.
Highest References and all particulars supplied on application.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Padiham and Hapton Local Board invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR, produced at their Gas-Works, during the year ending March 25, 1890.
For particulars, apply to the undersigned.
J. R. SMITH,
Clerk to the Board.
Padiham, Feb. 27, 1889.

BARMOUTH GAS-WORKS.

TENDERS are invited for a Gasholder 50 feet diameter and 16 feet deep, with or without Iron Tank; Two PURIFIERS 6 feet square, 5 feet deep; and 8 LATION METER with 6-inch Connections. Also, for erecting the same.
Specifications and all other particulars can be seen at the Offices of Mr. Henry Dennis, Rusbon, to whom tenders for all or any part must be sent not later than the 25th inst.

TENDERS FOR TAR AND LIQUOR.

THE Rugby Gas Company are prepared to receive TENDERS for the Surplus TAR and LIQUOR made at their Works, for either One, Two, or Three years, commencing the 31st of March.
Tenders to be sent in, under cover, to the undersigned on or before Wednesday, the 3rd of April.
The Directors do not bind themselves to accept the highest or any tender.
Particulars may be had from
P. SIMPSON, Manager.
Rugby, March 9, 1889.

BOROUGH OF CHORLEY.

TO RETORT, ETC., MANUFACTURERS.

THE Chorley Corporation invite Tenders for the supply of 47 D-shaped GAS-RETORTS 15 in. by 13 in. by 9 ft. 6 in. long; and about 15 tons of ground FIRE-CLAY for setting same.
Any further information may be obtained on application to Mr. Wm. Blackledge, Gas Manager, Chorley.
Tenders, endorsed "Tender for Retorts, &c.," to be sent to me not later than Four o'clock on Wednesday afternoon, the 20th of March inst.
By order,
THOS. A. JACKSON, Town Clerk.
Town Hall, Chorley, March 5, 1889.

TENDERS FOR GAS COAL.

THE Malvern Local Board invite Tenders for the supply of 1000 tons of best screened SILKSTONE GAS COAL, to be delivered and stacked at their Gas-Works, Great Malvern, between the 1st of April and the 30th of June, 1889, at such times and in such quantities as may be required.
Tenders to be sent to the undersigned, endorsed "Gas Coal," on or before Monday, the 18th inst.
The Board do not bind themselves to accept the lowest or any tender.
By order,
WM. LAMBERT,
Clerk to the Board.
Local Board Offices, Malvern,
March 5, 1889.

EXHAUSTER WANTED.

THE Gas Committee of the Corporation of Blackpool are prepared to receive TENDERS for the supply of a BEALE GAS EXHAUSTER, capable of passing 50,000 feet per hour; also HYDRAULIC REGULATOR for Steam.
Particulars may be obtained at the Office of the undersigned.
Tenders to be endorsed outside, and addressed to the Chairman of the Gas Committee by the 23rd day of March.
By order,
JOHN CREW, Gas Engineer.
Corporation Gas-Works, Blackpool,
March 10, 1889.

CORPORATION OF WIGAN.

THE Gas Committee invite Tenders for the following, to be supplied over a period of One year, commencing on the 26th inst.:—WET and DRY GAS-METERS, IRON TUBE and FITTINGS, BRASS TUBE and FITTINGS, LEAD PIPE, and PIG LEAD.
Particulars from the undersigned.
The lowest tender not necessarily accepted.
Tenders, sealed and endorsed, to be delivered to R. Darlington, Esq., Town Clerk, on or before Tuesday the 19th inst.
JOS. TIMMINS, Engineer, &c.
Borough Gas-Works, Wigan,
March 6, 1889.

THE Directors of the Farnham Gas Company, Limited, invite TENDERS for the Supply and Delivery of 500 tons of the Best NEW PELTON or PELAW MAIN GAS COAL, in quantities of 50 tons, between the 31st of March inst., and the 30th of June next.
The price to be per ton delivered free at Farnham, Surrey, Railway Station.
Sealed tenders (on forms which can be had on application to the undersigned), endorsed "Tender for Coal," to be sent in to me not later than Monday, the 25th of March inst., at Twelve o'clock noon.
The Directors will not be bound to accept the lowest or any tender.
WILLIAM WELLS, Secretary.
Farnham, Surrey, March 5, 1889.

CORPORATION OF BURNLEY.

THE Gas Committee of the above Corporation invite TENDERS for the purchase of TAR to be produced at their Gas-Works during the year ending the 25th of March, 1890.

Approximate quantity, 2000 tons.

The Tar will be delivered into the Contractor's boats at the Gas-Works Wharf, on the Leeds and Liverpool Canal.

The Contractor will be required to deposit the sum of £500 as security for the due fulfilment of the Contract.

Tenders, under seal, endorsed "Tender for Tar," stating price per ton, to be addressed to the Chairman of the Gas Committee, and delivered at the Town Hall, Burnley, on or before Wednesday, the 13th inst.

WALTER SOUTHERN, Town Clerk.

Town Hall, Burnley, March 1, 1889.

HARTLEPOOL GAS AND WATER COMPANY.

RETORT-FITTINGS, ETC.

THE Directors of the Hartlepool Gas and Water Company are prepared to receive TENDERS for the supply of RETORT-FITTINGS required in the erection of 56 additional Retorts at their West Hartlepool Works.

Plans and specifications may be seen, copies of same obtained, together with any further information, upon application to the Company's Engineer, Mr. Thomas Bower.

Tenders, sealed and endorsed "Tender for Retort-Fittings," to be sent to the undersigned not later than Tuesday, the 12th day of March next.

The Directors do not bind themselves to accept the lowest or any tender.

THOMAS TREWHITT, Secretary.

Hartlepool Gas and Water Company's Offices,
West Hartlepool, Feb. 19, 1889.

BOLTON CORPORATION GAS DEPARTMENT.

TENDERS WANTED.

THE Bolton Corporation Gas Depart- ment are prepared to receive TENDERS for a Supply, during the year ending the 25th of March, 1890, of any of the undermentioned articles, viz:—

Fire-Clay Retorts, Bricks, &c.	Wrought-Iron Tubes and Fittings.
Cast-Iron Pipes.	Lime.
Lead Tube.	Sulphuric Acid (Brown Vitriol).
Gas-Meters.	

Particulars may be obtained on application to the Office Superintendent (Mr. Walsh), Gas Offices, Bolton.

Sealed tenders, endorsed "Tender for ," stating price and terms delivered, to be addressed to Mr. Alderman Miles, J.P., Chairman, and delivered at the Gas Offices, on or before Thursday, the 14th of March, 1889.

By order,
R. G. HINNELL, Town Clerk.

Town Hall, Bolton, March 1, 1889.

THE Corporation of Middleton are prepared to receive TENDERS for the following Articles required at their Gas-Works during the ensuing year:—

WET and DRY GAS-METERS.
GAS and STEAM TUBES and FITTINGS.
RETORTS, FIRE-BRICKS, and FIRE-CLAY.

The Retorts to be delivered at the Middleton Railway Station, and the other Articles at the Gas-Works, Middleton, free of carriage.

Tenders, addressed to the Chairman of the Gas Committee, to be delivered at my office on or before Wednesday, the 20th day of March, 1889, endorsed "Tender for Meters," "Tubes," or "Retorts," as the case may be.

Further particulars may be obtained from Mr. Hartley, Gas Manager.

The Corporation do not bind themselves to accept the lowest or any tender.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton, near Manchester,
March 11, 1889.

LEEDS CORPORATION GAS DEPARTMENT.

TENDERS required as below:—

For Turned and Bored and other Pipes, Bends, Tees, Syphon Wells, and other irregular Pipes.
For Brass Main Cocks.
For 2½, 3, and 4 inch Self-Faced Bradford or Halifax Flags.
For Craven or Derbyshire Lime.
For Retort Mouthpieces, Stand-pipes, Door Frames, Special Bends, Tees, Flange Pipes, &c.
For Wrought-Iron Tubes.

Samples may be seen on application at the Stores Department, Gas-Works, Meadow Lane; and forms of tender and specification may be had of Mr. Lupton, at the Offices of the Gas Department, Municipal Buildings.

Sample bundles of ½-inch tubes to be sent, addressed to the Stores Department aforesaid, not later than Saturday, the 16th inst.

Endorsed tenders, addressed to the Chairman, will be received not later than Wednesday, the 20th inst.; and no tender will be considered except on the form provided.

The lowest or any tender will not necessarily be accepted.

SPENT OXIDE OF IRON.

THE Brighouse Local Board are pre- pared to receive TENDERS for the purchase of about 70 tons of SPENT OXIDE of IRON, now lying at the Gas-Works ready for immediate delivery.

Payment, cash on delivery.

The Local Board will deliver the Oxide into barges on the Calder and Hebble Canal (alongside the Gas-Works), or into railway trucks at Brighouse Station.

Further particulars and sample can be obtained upon application to the undersigned.

Tenders are to be sent in, addressed to Richard Kershaw, Esq., Chairman of the Local Board, Public Offices, Brighouse, on or before Wednesday, the 20th day of March, 1889, endorsed on the outside "Spent Oxide."

JAMES PARKINSON,
Engineer and Manager.

Public Offices, Brighouse, March 1, 1889.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is hereby given that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 27th inst., at Half-past Twelve o'clock precisely, to transact the usual Business, and to declare the Dividend for the Half Year ended the 31st of December last.

NOTICE IS HEREBY ALSO GIVEN that the Transfer Books of the Company will be closed on the 16th, and re-opened on the 28th inst.

By order of the Court of Directors,
FREDERIC LANE LINGING,
Secretary.

Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
March 8, 1889.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is hereby given that the HALF-YEARLY ASSEMBLY of Proprietors will be held at the Company's Office, St. Helen's Place, Bishopsgate, E.C., on Tuesday, the 2nd of April, 1889, at Twelve o'clock noon precisely, pursuant to Act of Parliament.

The Transfer Books in respect of the Ordinary Stock will be closed on the 19th of March inst., and re-opened on the 9th of April, on which day the Dividends on this Stock will be payable.

By order,
I. A. CROOKENDEN, Secretary.

St. Helen's Place, E.C., March 5, 1889.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Invention may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

ROBERT MARSHALL,
CANNEL COAL MERCHANT
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

AN OLD-ESTABLISHED
ENGLISH LIGHTING COMPANY
IN LONDON,

Having first class Representatives throughout the United Kingdom, and facilities for introducing immediately any

Genuine Improvement

CONNECTED WITH

GAS or OIL LIGHTING, HEATING, GAS FITTINGS or APPARATUS,

Is open to treat with parties having such INVENTIONS, with a view of taking up a SOLE AGENCY.

Send full particulars to "LIGHTING," 104, Regency Street, LONDON, S.W.

THOMAS'S
JOINTLESS GAS PRESSURE GAUGE.

MR. A. THOMAS, COWES.

DEAR SIR,—Please accept my best thanks for your labour-saving Gas-Pressure Gauges I had of you last November. I am sure they require no recommendation. If once used, other orders must follow. None but those using them know their worth between the Hydraulic Main and the Station Meter. I shall replace all my old ones with yours.

Yours respectfully,
WM. BATES, Manager,
Gas Company, Worksop.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES and FIRE-CLAY and every Article suitable for
GAS AND WATER WORKS.

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

COKE BREAKERS,
FROM £14 EACH.
(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, S.E.

THE ONLY RELIABLE
DRY CENTRE-VALVE.

WORKING ONE, TWO, THREE, OR FOUR PURIFIERS ON AT THE TIME.

ALSO MADE FOR TWO OR THREE PURIFIERS.

No Springing. No Leakage. No Foul Gas passed in Changing. Special Facility for Blowing the Air out of the Fresh Box before putting in Action, without driving it forward into the Holders.

Write for Prospectus.

ALSO DOUBLE-ACTION DOUBLE-FACED GAS & WATER VALVES.

F. WECK, 86, NEW STREET, BIRMINGHAM.

MARQUIS OF LOTHIAN'S
NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO

MR. JOHN MORISON,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

SIXTH YEAR. Now Ready (Demy 8vo., Price 5s., or 5s. 6d. post free),

THE COMPLETE REPORTS OF THE PROCEEDINGS
OF THE VARIOUS
DISTRICT ASSOCIATIONS OF GAS MANAGERS
FOR 1888.

FORMING A COMPANION VOLUME TO THE TRANSACTIONS OF THE GAS INSTITUTE, WITH WHICH IT IS UNIFORM IN SIZE.

. THE VOLUMES for 1883 to 1887 ARE STILL ON SALE.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

TELESCOPIC EXTENSION LADDERS & STEPS. All sizes, many patterns, large stock for all purposes, indoor and outdoor. Admirable inventions.

HEATHMAN & CO.,

1, Endell St., & 11, High St., Bloomsbury, London, W.C.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co.,

ALBERT WORKS, WIDNES.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

MIRFIELD, NORMANTON.

GAS AND WATER PIPES.

1¼ to 12 IN. BORE.

THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GAS COAL.

POPE & PEARSON, LTD.,

have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles; or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17¼ candles.

One ton yields 12¼ cwt. of good coke.

This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

TROTTER, HAINES, & DORBETT,

BRETTELLS' ESTATE

FIRE-CLAY & BRICK WORKS,

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK,

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAYS.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

CAST-IRON PIPES

FOR GAS AND WATER.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

LUX'S GAS-BALANCE.

(For Description, see JOURNAL OF GAS LIGHTING, July 17, 1888.)

For the Automatic Determination of the Specific Gravity and the Composition of Gases.

Patented in Great Britain and Abroad.

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55, 55a, 56, Millbank St., Westminster,

LONDON, S.W.

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LANEMARK COAL Co., LTD.,

Now offer their superior

GAS COALS

LANEMARK CANNEL.

Yield of Gas per ton . . 10,880 cub. ft.
Illuminating Power . . 29·21 candles.
Coke per ton . . . . 1266·96 lbs.

LANEMARK GAS COAL.

Yield of Gas per ton . . 11,879 cub. ft.
Illuminating Power . . 17·88 candles.
Coke per ton . . . . 1285·58 lbs.

LANEMARK GAS BRIQUETTES.

Yield of Gas per ton . . 10,784 cub. ft.
Illuminating Power . . 22·70 candles.
Coke per ton . . . . . 1320 lbs.

For Prices and Analyses, apply to

LANEMARK COAL Co., Ltd.,

NEW CUMNOCK, N.B.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, LIMITED,

SHEAF AND SPRING WORKS,

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MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNER RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13 155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.,

COAL OWNERS, NEWCASTLE-ON-TYNE,

Or E. FOSTER & CO., 21, John St., Adelphi LONDON, W.C.

SPENT LIMES NO LONGER WASTE PRODUCTS!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

MOST EFFECTIVELY AND *ECONOMICALLY RESTORES* LIME WASTES CONTINUOUSLY.

The Patentee having under his several Patents effected a complete solution of the Spent Lime difficulty, most confidently solicits the consideration of the fact by the Engineers and Managers of Gas Companies, Gas Corporations, and other SpentLime producers. The adoption of these Patents secures the following amongst other advantages, viz.:—1st. Nuisance is avoided, and the utmost convenience and comfort in Gas purification are secured. 2nd. The Lime is recovered at from one-third to one-half the cost of new Lime, or from 5s. 6d. to 7s. 6d. per Ton (depending on extent of works and working charges). 3rd. The Lime is either recovered for Building and Agricultural purposes, or specially and continuously for Gas purification—no limit being assigned to its durability. 4th. Nearly the whole of the valuable sulphur is collected and sold. 5th. By the Patentee's Improved Furnace, breeze or inferior cannel coke only is required as a fuel. The process has been worked for a considerable time by several important Gas Companies and Corporations throughout the Kingdom, and with the most satisfactory results. The Patentee erects, proves, and grants working on very moderate terms.

Further particulars may be had on application to A. F. WILSON, Esq., Assoc. M. Inst. C.E., 12, Walbrook, London, E.C., Agent for London
J. E. FISHER, Esq., Stourbridge, Agent for the rest of England, Wales, and Ireland; or to the Patentee—

GEO. R. HISLOP, Engineer, GAS-WORKS, PAISLEY, N.B.

JOHN BROWN & CO., LIMITED,

ATLAS STEEL AND IRON WORKS, SHEFFIELD,

ALDWARKE MAIN GAS COAL.

This Coal yields 12,600 feet of 19-candle gas per ton.

Weight of illuminating matter in pounds of sperm, 820·80. Very free from impurities.

WARNER'S RETORT-HOUSE MACHINERY.

[*As Illustrated and Described in the* JOURNAL *for May* 4, 1880.]

Communications to be addressed to

W. J. WARNER, GAS-WORKS, SOUTH SHIELDS.

D. HULETT & CO.

Invite attention to the following Specialities:—

PATENT STREET LAMPS,

NO PUTTY OR OTHER MATERIALS ARE REQUIRED TO SECURE THE GLASS. PRICE 9s. 9d. EACH NET.

D. Hulett's Improved Service Cleanser, for the removal of Naphthalene and other obstructions in Service-Pipes. Price 70s. net.

IMPROVED HIGH-POWER LANTERNS; PRICES ON APPLICATION.

Patentees of Improved Wet and Dry Gas-Meters.

Makers of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

SHOW-ROOM AND WORKS: 55 & 56, HIGH HOLBORN, LONDON.

Glass-House Furnace Bricks.

BLAST-FURNACE BRICKS.

Best Staffordshire Blue Bricks.

Please address "MOBBERLEY & PERRY, STOURBRIDGE," as there are other Firms similar in name.

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SILICA BRICKS & BLOCKS FOR INTENSE HEATS

CASTINGS & EVERY REQUISITE FOR GAS WORKS

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SPECIAL BRICKS FOR SECONDARY AIR SUPPLY & REGENERATOR FURNACES

EXPERIENCED RETORT-SETTERS SENT TO ALL PARTS OF THE KINGDOM

BLOCKS, LUMPS, AND TILES,

Boiler Seatings, and Flue Covers

Best Glass-House Pot & Crucible Clay

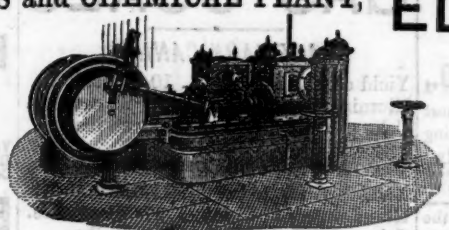
Please address "MOBBERLEY & PERRY, STOURBRIDGE," as there are other Firms similar in name.

R. DEMPSTER & SONS, LIMITED.,

MANUFACTURERS of GAS and CHEMICAL PLANT, ELLAND, YORKS.

VALVES OF ALL DESCRIPTIONS AND FOR ALL PURPOSES.

LARGE STOCK KEPT.



DIRECT-ACTING RECIPROCATING EXHAUSTERS.

ALL VALVES TESTED TO 40lbs. AND FLANGES FACED.

Prompt delivery guaranteed.

MAKERS OF LIVESEY'S PATENT WASHERS FOR THE COLONIES AND ABROAD.

SPECIALITIES.

THE "NUGENT" RECUPERATIVE RETORT SETTINGS and FURNACES.

"ROBUS" IMPROVED RETORT SETTINGS, with COKE, TAR, and BREEZE FURNACES.

THE ABOVE SETTINGS & FURNACES ARE PROVING EMINENTLY SATISFACTORY.

Every Particular, with Estimates, forwarded upon Application to

MESSRS. J. & H. ROBUS,

CONTRACTORS FOR THE ERECTION OF GAS & WATER WORKS,

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FACE YOUR RETORT MOUTHPIECES.

JOHN RUSCOE calls attention to his Retort Mouthpiece and Lid Facing Machines, which are in extensive use; also to his Lathes, Drilling, Slotting, Grooving, and Planing Machines, Smiths' Hearths, Smithy Fans, Roots' Blowers; also special Screwing Machines for Gas Tubes and Bolts, Taps, Wrenches, Pipe Cutters, special Taper and Twisted Rymers, Drills, &c.

PATENT TWISTED TAPS, DIES, & CUTTERS.

Thousands in constant work, give universal satisfaction.

Work Easier, Less Friction, Last Longer, and do Better Work than straight Grooves.

Main Drilling Stand, with Cup Drills, 1¼ to 6 inch; Taps, Rymers, and Drills.

Ratchet Screwing Stocks, and Adjustable Once-up Stocks, Dies, Guides, &c.

Inquiries and Trial Orders Solicited. Everything Guaranteed. Apply to

JOHN RUSCOE, Albion Works, Hyde, near Manchester.

GAS COAL.

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REAL OLD SILKSTONE GAS COAL.

Address, THE STRAFFORD COLLIERIES COMPANY,
NEAR BARNSLEY, SOUTH YORKSHIRE.

CAST-IRON PIPES, ETC.

THOMAS SPITTLE, LTD.

[ESTABLISHED OVER 50 YEARS.]

CAMBRIAN FOUNDRY, NEWPORT, MON.,

MAKERS OF

CAST-IRON PIPES FOR GAS, WATER, AND STEAM;

ALSO

Retorts, Mouthpieces, Lamp-Posts, Hydraulic Mains, H-Pipes, Dip-Pipes, Buckstaves, Ash-pans, Sight-Holes, Syphons, Ascension-Pipes, Fire Doors and Frames, Fire-Bars, Hydrants, Valves, Purifiers, Tanks, Columns, &c., &c.

ALSO ALL WROUGHT-IRON WORK.

THE LARGEST MAKERS IN WALES.

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

WILLEY AND CO.,

GAS ENGINEERING WORKS,

COMMERCIAL ROAD, EXETER.

London Offices: 6 & 7, KING WILLIAM STREET, E.C.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single-Lift, any size. Some of the largest in the Kingdom erected by this Firm are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **Mr. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

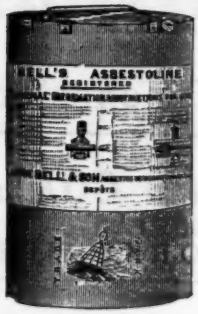
WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

BELL'S ASBESTOLINE.

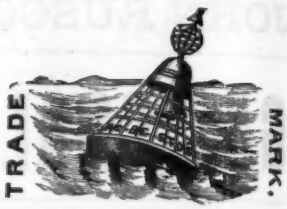
REGISTERED.



All kegs are labelled as above.

ADVANTAGES OF ASBESTOLINE.

ASBESTOLINE is the most efficient Lubricant for all bearings.
ASBESTOLINE is the cheapest Lubricant.
ASBESTOLINE saves from 50 to 90 per cent. of the Cost of Oil.
ASBESTOLINE is the Cheapest Lubricant.
ASBESTOLINE is favoured by Insurance Companies.
ASBESTOLINE is the most Inodorous Lubricant.
ASBESTOLINE is the safest Lubricant from Ignition.
ASBESTOLINE has beaten all other Lubricants in trials.
ASBESTOLINE is applicable in and out doors in every Climate.
ASBESTOLINE requires no special application.



BELL'S ASBESTOS.

CONSISTENCY OF ASBESTOLINE.

ASBESTOLINE, to meet all circumstances, is made in four degrees of consistency—A, B, C, and CC.

ASBESTOLINE, A, is specially adapted to ordinary Land Engines and Machinery, in and out door, in this country.

ASBESTOLINE, B, a little more solid, is for use on Steamships in temperate climates, also on land when it is desirable to have Lubricant stiffer than A.

ASBESTOLINE, C, is for use in tropical climates, both ashore and afloat. It is also invaluable in works in this country when the temperature is high.

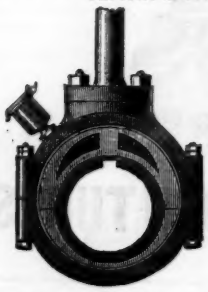
ASBESTOLINE, CC, is designed for use on Calenders, Paper-Machines, &c., where the bearings are heated by steam passing through, and sometimes is advantageously used instead of C.

The reputation of Asbestoline as a Lubricant of the highest efficiency in every kind of Machinery is established; and it has never been equalled by any other Lubricant in the numerous cases of special difficulty in which the best oils are ineffectual. It is used with marked success in Steel and Iron Works, Collieries, Cotton and Wool Mills, and other Textile Manufactories. In Corn-Mills it has proved invaluable on the roller and other modern machines. In Saw-Mills, on machines going up to 5000 revolutions per minute, its work has never been approached by any other Lubricant. On Electric Lighting Machinery, and in Steamships of all sizes throughout the world, the success of Asbestoline is unequalled. Many engines and machines of all descriptions give trouble, and show bad results both in working and wear, when the system of lubrication has not received due consideration. Engineering firms of the highest standing have given to it their powerful testimony and support.

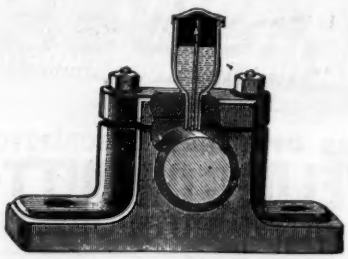
Supplied in Kegs, 28, 56, or 112 lb. Price, 2/3 per lb. Kegs Free. Special Terms for Large Quantities.

IMPORTANT TO EXPORT MERCHANTS.—*One pound of "Asbestoline" equals 2 gallons of Oil weighing 18lbs.; consequently the saving in freight is very considerable. Liberal Terms are conceded to Export Merchants.*

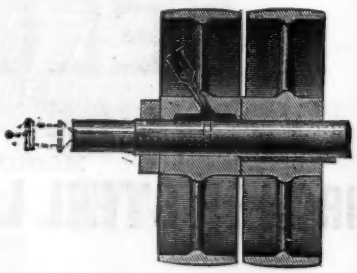
Below will be found illustrations of the mode of fixing Lubricators for Asbestoline to bearings. Full particulars of the various Lubricators supplied for Asbestoline, and the manner of fitting, in catalogue free on application.



Lubricator fitted to Eccentric of Vertical Engine



Showing Section of Lubricator fitted to ordinary Bearings.



Lubricator in different position for Loose Pulleys.

THE ATTENTION OF

ENGINEERS, AND ALL USERS OF STEAM POWER AND MACHINERY,

IS SPECIALLY INVITED TO THE FOLLOWING REPORT.

Owing to the number of Greases now offered, samples of BELL'S ASBESTOLINE were submitted to Otto Hehner, Esq., for analysis, and the subjoined Report fully proves BELL'S ASBESTOLINE to be the safest as well as the best Lubricant for all purposes:—

The Laboratory, 11, *Billiter Square, E.C., London, May* 3, 1888.

I have subjected a sample of Bell's Asbestoline taken from the stores of Messrs. J. Bell and Son, in Southwark Street, to a number of tests, in order to ascertain whether its use in Mills or Factories might contribute to the danger from Fire.

I found that Asbestoline **ignites only with the greatest difficulty** when brought into contact with flame; that wood and other combustible material soaked in Asbestoline burns, if anything, with greater difficulty than by itself; that its **flashing point** is so high that it **lies beyond the range of Mercurial Thermometers**; and that consequently no friction obtainable in the ordinary run of machinery is capable of developing inflammable vapours from it.

Bell's Asbestoline is **as absolutely safe a Lubricant as can be desired or obtainable.** In the case of fire breaking out from any cause, it does not assist the conflagration; and it is **quite incapable of leading to spontaneous combustion**, either by itself or in contact with inflammable material.

From the physical nature of Asbestoline its use is of necessity perfectly clean and free from waste.

(Signed) OTTO HEHNER, Public Analyst.

Illustrated Priced Catalogue, with numerous Testimonials by Leading Firms, free on application.

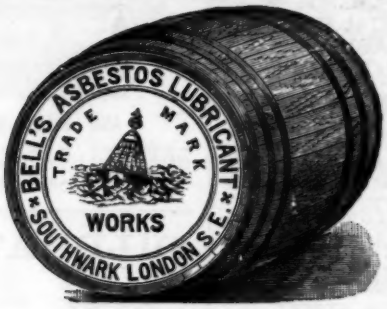
BELL'S ASBESTOS COMPANY, LIMITED,

DEPOTS—MANCHESTER: Victoria Buildings, Deansgate. LIVERPOOL: 2, Strand Street, James Street.

BELL'S ASBESTOS LUBRICANT.

(REGISTERED.)

All Drums marked as above.



Every Cask is sent out as above.

All Corks are sealed as above.

Any Customer receiving Oil sold as **Bell's Asbestos Lubricant**, and Cask, Drum or Corks not marked as above, is earnestly requested to forward us sample and particulars of where obtained.

The following Oils, refined and prepared by our Asbestos process, are specially recommended to Users of Machinery of every kind in all parts of the world. We guarantee the quality of each to be unequalled at the price for the purpose named, and a Sample Drum, containing 5 gallons of each or any sort, will be sent on approval to any respectable firm in any part of the world :—

BELL'S SPECIAL GAS-ENGINE OIL.—This oil is guaranteed to stand flame temperature, and is suitable for light Machinery and Shafting where gas power is used.
Price **2s. 9d.** per gallon.

1a.—BELL'S SPECIALLY PURIFIED DARK CYLINDER AND VALVE OIL.—This oil is guaranteed not to gum, corrode, or in any way injure metal surfaces. It will not carbonize, nor leave any deposit whatever in cylinders or condensers, nor will it injure india-rubber valves. It is absolutely pure hydrocarbon, and will work admirably in all good Sight-feed Lubricators.
Price **3s. 9d.** per gallon.

2a.—Bell's Specially Refined and Purified Pale Cylinder and Valve Oil contains the same properties as 1a, and is one of the very best Oils of the Valvoline class in the market.
Price **4s. 6d.** per gallon.

BELL'S PALE COMPOUND MACHINERY AND ENGINE OIL FOR EXTERNAL LUBRICATION ONLY.

"3c."—For small and medium-sized Engines, Shafting, and quick-running Machinery, displacing Lard Oil. Price **2s. 6d.** per gallon.

"3c. Special."—Heavier bodied than "3c.," and suitable for Locos. and Stationary Engines up to 300-H.P., displacing Olive Oil.
Price **2s. 9d.** per gallon.

"3c. Marine."—Much heavier than "3c.;" suitable for Marine Engines and heaviest Stationary Engines, Shafting, &c., displacing Castor Oil. Price **3s.** per gallon.

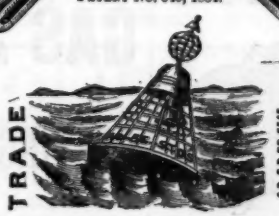
BELL'S AGRICULTURAL MACHINE OIL, for Traction Engines, Road Rollers, and all Machines working out of doors. This Oil will not set on bright parts, is not affected by extreme cold or the rays of the sun. Price **2s. 9d.** per gallon.

For other Qualities and Prices, with Testimonials, see Catalogue, free on application.

BELL'S ASBESTOS EXPANSION SHEETING.

SECTION OF SHEETING.
PATENT No. 640, 1884.

The above, which can only be obtained from this house, is recognized as the Most Efficient and Economical Jointing Material in use. It is composed of a specially prepared India-rubber Compound, protected by a covering of Vulcanized Asbestos Sheeting, as shown above, and as it is the only Jointing Material which adequately combines PERMANENT ELASTICITY WITH HEAT RESISTANCE, the advantage it possesses will at once be seen.



BELL'S ASBESTOS.

EXPANSION RINGS.

The centre from which the requisite elasticity is obtained will adapt itself to uneven surfaces to which it may be applied, and allow expansion and contraction to be fully taken up. The covering, being of Asbestos Cloth, imparts a protection to the centre, and so prolongs its elasticity. For Manhole, Mudhole, Steam-Pipe, and Mash-Tun Door Joints it is unequalled; and if applied as directed, a ring can be used many times over.

Price **6s.** per lb. in Sheets. Rings made up to Template, **9s.** per lb.

Made from 1-Ply for Cylinder and Faced Joints to any thickness for Uneven Surfaces.

Illustrated Priced Catalogues, with numerous Testimonials from Leading Firms, free on application.

118, SOUTHWARK STREET, LONDON, S.E.

CARDIFF: West Bute St. BIRMINGHAM: 7, John Bright St. HULL: Humber Dock Basin. GLASGOW: 35, Robertson St.

"THE METEOR."

NEW HIGH-POWER GAS-LAMP, WESTPHAL'S PATENT.
MOST INTENSE WHITE BRILLIANT GAS LIGHT.
MOST ECONOMICAL, SIMPLE, AND DURABLE.
DOES NOT GET OUT OF ORDER.
RIVALS THE ELECTRIC LIGHT.
NO ALTERATION REQUIRED TO EXISTING FITTINGS.
BURNER, BEING A CIRCULAR SLIT, DOES NOT CHOKE UP.

PARTICULARS & PRICES POST FREE.

HENRY GREENE & SONS,
SOLE CONSIGNEES FOR GT. BRITAIN & COLONIES,
153 TO 155, CANNON STREET,
LONDON BRIDGE, E.C.

WILLIAM INGHAM & SONS,

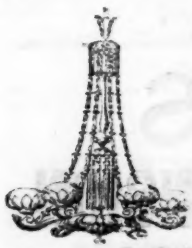
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing Adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

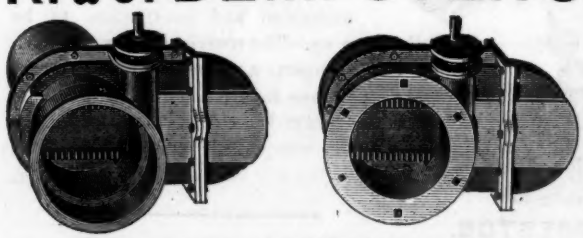
F. & C. OSLER,
(ESTABLISHED 1807)



MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES,
TABLE GLASS OF ALL KINDS,
CHANDELIERS IN BRONZE AND ORMOLU.
MODERATOR LAMPS.

100, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.

R. & J. DEMPSTER'S



TESTED GAS-VALVES.

The pinions of all our Slide Valves are now cut by special machinery from solid forgings. Valves of 10-in. bore and upwards are fitted with double racks, without extra charge. The flanges are all faced and made to standard dimensions, unless otherwise ordered. All valves are tested and guaranteed tight before leaving the works.

Upwards of 200 Valves kept in stock to facilitate quick delivery.

Prices and Dimension Lists sent on application.

All kinds of Faced and Hydraulic Centre and other Valves made to order.

GAS PLANT WORKS,
NEWTON HEATH, MANCHESTER.
London Office: 181 and 182, GRESHAM HOUSE, OLD BROAD STREET, E.C.

JOHN HALL & CO.,
STOURBRIDGE,
MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
RETORTS CAREFULLY PACKED FOR SHIPMENT.
A STOCK OF DIFFERENT SHAPES ON HAND.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE
Sole Manufacturers,
GODDARD, MASSEY, & WARNER, ENGINEERS
NOTTINGHAM,
OR TO
The Sole Agent,
MAURICE SCHWAB,
96, DEANSGATE, MANCHESTER.

The Apparatus has been supplied to the following Firms—
BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
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RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
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And to the following Gas Companies and Corporations:—

ILKESTON.	BURY.	CHORLEY.
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GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY.
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THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

S. PONTIFEX & CO.,

GAS and WATER ENGINEERS,

Manufacturers of and Contractors for the Maintenance of

PUBLIC LAMPS & LANTERNS;

GLASS—Flint, Opal, and Bent in Stock, and Cut to Sizes

WELL LAMPS, STREET NAME TABLETS,

LAMP COLUMNS, HEAD IRONS, PUTTYLESS LAMPS,

LANTERN COCKS, REGULATORS,

Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

BROWN'S PATENT

LAMPLIGHTERS' TORCHES.

PROPRIETORS AND MANUFACTURERS OF

BOX'S PATENT

PUTTYLESS STREET LAMP.

This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

S. PONTIFEX & CO., 22, COLEMAN ST., LONDON.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

CLAYTON, SON, & CO.

ESTABLISHED A QUARTER OF A CENTURY. LIMITED.

MANUFACTURERS OF ALL KINDS OF

GASHOLDERS

AND

GAS PLANT

OF EVERY DESCRIPTION.

LONDON OFFICE: 60, QUEEN VICTORIA STREET, E.C.

HUNSLET, LEEDS.

JOHN ABBOT & CO., LIMITED.

ESTABLISHED 100 YEARS.

THE LARGEST

SULPHATE PLANT MANUFACTURERS

IN THE TRADE.

The present Low Prices render it absolutely necessary for Gas Engineers to use the commonest Pyrites Acid, and obtain the whitest and best quality of Sulphate, so as to obtain a better price and more ready market.

For this purpose they strongly recommend the

NEW IMPROVEMENTS

Combined with their

PATENT SAFETY CLOSED SATURATORS

AND

Improved Self-acting Steam Liming Process

Under pressure, effecting a considerable Saving in Time in Working off the Contents of each Still.

— OVER —

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IN OPERATION.

A number of Plants on the Open System recently remodelled with greatly improved results.

GAS AND WATER PIPES, HYDRAULIC CRANES,

CAPSTANS, BOILERS, ROOFS, TANKS, &c.

Messrs. ABBOT & Co. (Works at Gateshead-on-Tyne) employ 2000 men, including several experienced Plumbers, to erect New and remodel Old Sulphate Plants.

Applications to be made to the

LONDON OFFICE,

SUFFOLK HOUSE, CANNON STREET, E.C.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known **HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES,** and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE STREET, BIRMINGHAM—AGENT: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN, BIRMINGHAM." TELEPHONE No. 200.

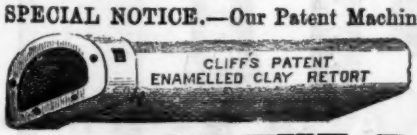
JOSEPH CLIFF AND SONS,

THE ORIGINAL (ESTABLISHED 1795).

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.



AT THE PARIS EXHIBITION, 1878,

THREE MEDALS AND HONOURABLE MENTION

WERE AWARDED TO

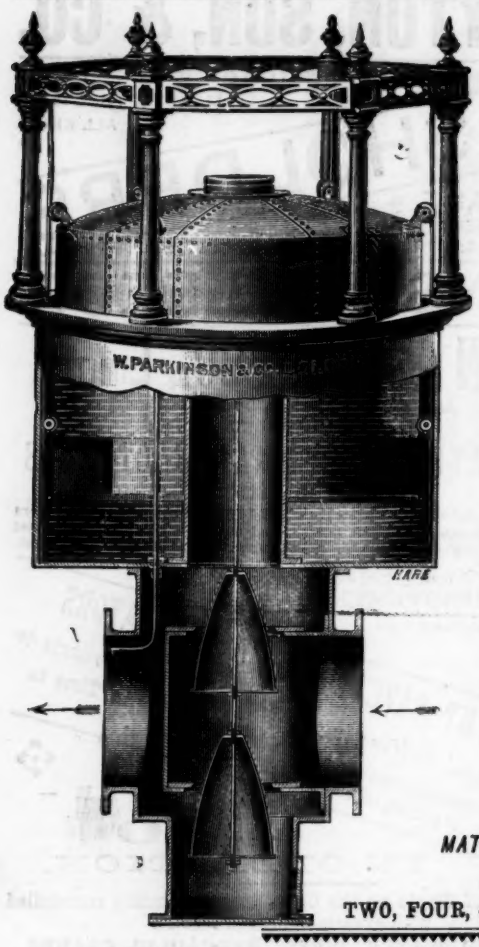
JOSEPH CLIFF & SONS,

For their Various Exhibits, amongst which is a

SILVER MEDAL FOR THEIR PATENT MACHINE-MADE RETORTS AND FIRE-BRICKS,

Being the Highest Honour given for this Class.

London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.



PARKINSON'S
IMPROVED
EQUILIBRIUM GOVERNOR.

This Governor combines all the advantages of simplicity with perfect efficiency. It effectually overcomes the difficulty of varying pressures experienced by many Engineers owing to the change of light and heavy gasholders, and their causes.

Two parabolic cone valves are employed, one fitted above the other, as shown in the Engraving. By this means the flow of gas is divided, and passes equally through the valves, which are in perfect equilibrium, whatever position they occupy.

No "compensating arrangements" are therefore needed; no attention is required; and the management of the Governor is made as simple as it possibly can be.

In actual practice this Governor is found to be perfect in its action; and every detail in construction is carried out with the utmost care.

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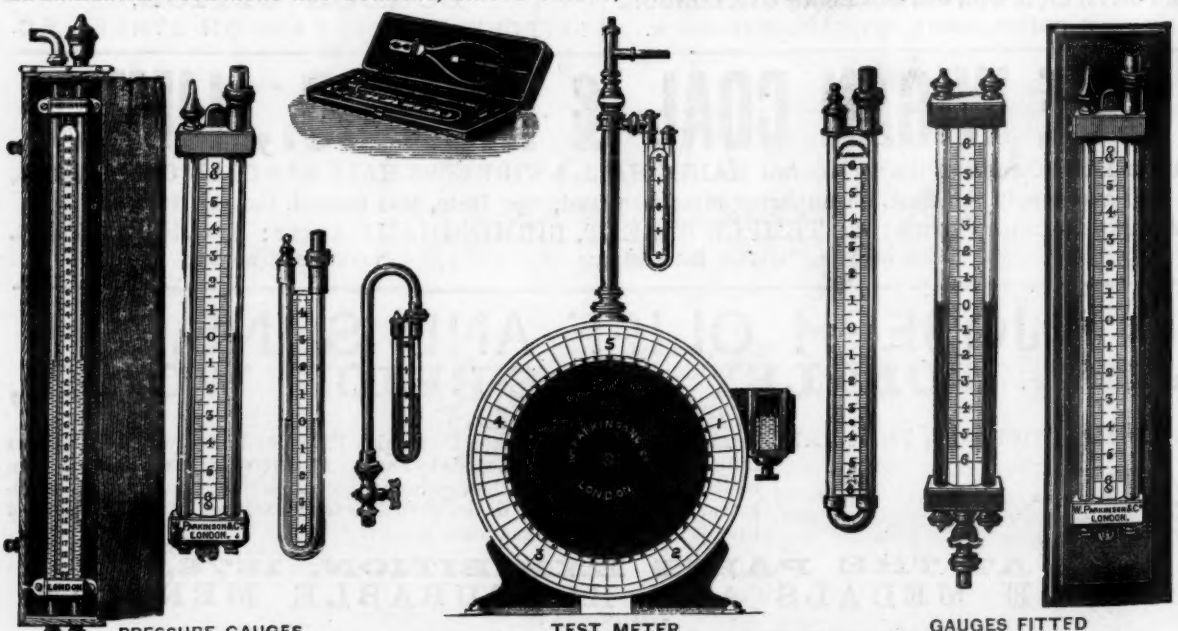

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GOLD & SILVER MEDALS, Health Exhibition, London, 1884. SILVER MEDAL, Inventions Exhibition, 1885.

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Telegraphic Address: "INDEX LONDON."

[See also Advt., p. 472.

London: Printed by WALTER KING (at the office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street in the City of London.—Tuesday, March 12, 1889.